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JOHNSON PNEUMATIC SYSTEM OF TEMPERATURE AND HUMIDITY CONTROL

JOHNSON
SYSTEM OF TEMPERATURE AND HUMIDITY CONTROL

JOHNSON SERVICE COMPANY

BRANCH OFFICES

ATLANTA, GEORGIA, 206 Bona Allen Building.
ALBANY, NEW YORK, 4 Ramsay Place.
BOSTON, MASSACHUSETTS, 31 Waltham Street.
BUFFALO, NEW YORK, 2 Erie County Bank Building.
CHICAGO, ILLINOIS, 1355 Washington Boulevard.
CLEVELAND, OHIO, Plymouth Building, 2028 E. 22nd Street.
CINCINNATI, OHIO, 319 Gwynne Building.
DALLAS, TEXAS, 510 Slaughter Building.
DES MOINES, IOWA, 210 Masonic Temple.
DETROIT, MICHIGAN, 42 West Montcalm Street.
DENVER, COLORADO, 1228 California Street.
GREENSBORO, NORTH CAROLINA, Greensboro News Company Bldg.
INDIANAPOLIS, INDIANA, 111 Pembroke Arcade.
KANSAS CITY, MISSOURI, 411 E. 10th Street.
LOS ANGELES, CALIFORNIA, 708 W. 45th St., 605 Van Nuys Bldg.
MINNEAPOLIS, MINNESOTA, 308 3rd Ave., South.
NEW YORK CITY, N. Y., 118 East 28th Street.
PITTSBURGH, PENNSYLVANIA, Century Building.
PORTLAND, OREGON, 404 Failing Building.
PHILADELPHIA, PENNSYLVANIA, 258 S. Van Pelt Street.
SEATTLE, WASHINGTON, 452 Colman Building.
SAN FRANCISCO, CALIFORNIA, 417 Rialto Building.
SALT LAKE CITY, UTAH, 610 McIntyre Building.
ST. LOUIS, MISSOURI, 14 North 12th Street.

JOHNSON TEMPERATURE REGULATING COMPANY OF CANADA, Ltd.

CALGARY, ALBERTA, 605 Second Street, West.
MONTREAL, QUEBEC, 127 Madison Avenue, Notre Dame de Grace.
TORONTO, ONTARIO, 145 Wellington Street, West.
VANCOUVER, BRITISH COLUMBIA, 550 6th Avenue, West.
WINNIPEG, MANITOBA, 259 Stanley Street.

MAIN OFFICE AND FACTORY:
MILWAUKEE, WISCONSIN

FOREWORD

This book is given you for three purposes: to help you appreciate the value and necessity of Automatic Temperature Regulation, to show you the part played by the Johnson Service Company in the invention and development of this art, and to describe in detail the various articles such as thermostats, valves, dampers, air compressors, humidostats, made by the Johnson Service Company, their functions and their qualities.

It has been made, we hope, interesting to read and non-technical in style; it contains facts that will interest the owners and managers of buildings, as well as architects and contracting engineers; and it presents a conservative statement of experience relating to Automatic Temperature Regulation and the Johnson system.

JOHNSON SERVICE COMPANY

MAIN OFFICE AND FACTORY:

MILWAUKEE, WISCONSIN

TD 90 B6 J4

JULY, 1924.

MAIN OFFICE AND FACTORY of JOHNSON SERVICE COMPANY MILWAUKEE, WIS.

Located at the corner of Michigan and Jefferson streets, in the heart of the business district, four blocks from the C. & N. W. Ry. station, six blocks from the station of the C., M. & St. P. Ry.; built of reinforced concrete, brick and stone; seven stories high and, including basement, has a floor space of 150,000 sq. ft.

BASEMENT——*Iron Storage and Garage.*
FIRST FLOOR——*General Offices, Receiving and Shipping Departments.*
SECOND FLOOR——*Damper and Valve Assembly Department.*
Air Compressor Testing Department.
THIRD FLOOR——*Machine Shop and Tool Room.*
FOURTH FLOOR——*Stock Rooms.*
FIFTH FLOOR——*Thermostat and Thermometer Departments.*
SIXTH FLOOR——*Plating and Finishing Department.*
Experimental Laboratories.
SEVENTH FLOOR——*Foundry.*

Unbiased Experts Endorse Automatic Temperature Regulation

Abstract from Chapter—Automatic Heat Control, American Society of Heating and Ventilating Engineers' Guide, 1924.

AUTOMATIC HEAT CONTROL, despite a popular impression that it is a luxury, is one of the fundamental principles of life, and without its influence life on the earth would be impossible. The intelligent application and control of heat in one way or another is a fundamental of civilization. It is almost impossible to conceive of any contact we have with any physical adjunct of civilization in which heat and the accurate control of heat have not had a major influence.

Temperature control is achieved by preventing over-heating. It develops from this that automatic heat control in itself must always effect an economy.

In order to be practically useful, heating plants must be able to warm living spaces when extreme cold prevails outside. Extreme cold outside is rare, occurring perhaps during 5 per cent of the heating season. Unless it is held in check, the big, powerful heating apparatus which must be provided against the 5 per cent time, will overheat the occupants and waste their stored and perhaps irreplaceable fuel during 95 per cent of the heating season.

By far the greatest number of heated rooms in the world probably have single direct radiators, and the tendency is for these radiators to be hot all over, or cold all over. Variations of many degrees in temperature in one hour are possible. With stoves, or fireplaces, the intensity of the fire can be varied, as the cold outside indicates, but the grate must be large enough to burn the maximum amount of fuel, and even a grate or a stove is difficult to control for one-half or one-quarter capacity.

Ventilated rooms, especially when fans are used, may have very rapid air changes, and the temperature variation may be many degrees in even one minute. Herein lies the great opportunity for automatic heat control, preventing the unbearable sudden changes which cause drafts; promoting comfort and happiness; eliminating waste; conserving limited, stored fuel.

It has come to be universally admitted that mechanically ventilated buildings must have automatic heat control. Every residence needs automatic heat control; shutting off a radiator or a register, which a persecuted occupant may sometimes do (he generally opens a window) has little if any effect on the remote fire in the heater, and fuel used for overheating is always wasteful.

When buildings are heated from central stations, especially those using steam or vapor, automatic heat control is an imperative necessity, since heat must be available at all times in full power; it is beyond human ability to manipulate manual controlling apparatus with sufficient nicety to prevent overheating.

When gas or oil is used as fuel, automatic control of combustion is necessary in order that the fuel costs may not be prohibitive. With quickly responsive fuels such as gas or oil, automatic heat control applied to the burners is remarkable and effective; its influence is especially noticeable.

With coal as fuel and automatic control of combustion there is so much stored heat in the firebox that necessarily the volume of heat output lags behind the thermostatic influence of a change in dampers. Ashes, clinkers, etc., affect the intensity of the fire; but nevertheless the automatic control is far superior in comfort and economy to manual control.

Service hot water constantly fluctuates between a scalding and an unsatisfactory lukewarm temperature unless controlled automatically.

Temperature and humidity, or vapor content, is constantly associated as factors of importance under all living conditions and in nearly all industrial applications of heat. Automatic heat control becomes automatic humidity control as soon as the influence of evaporation can be applied. It follows that a wet bulb thermometer indicates the percentage of vapor and a moistened thermostat can be made to regulate humidity automatically. * * * * * * * * *

There have been many tests to demonstrate the effect of automatic heat control. For instance, with an average outside temperature of 36 degrees it was found that with the usual sort of installation the thermostat would keep the heat shut off 21 hours out of a possible 24; that with an average outside temperature of 16 degrees the heat was on the radiator only a trifle more than 5 hours per day.

The savings in fuel to be gained by automatic heat control are enormous. In many large institutions, such as universities, having central stations, high-grade supervision, meters, etc., the savings have proven to equal one-half of the uncontrolled consumption.

In one metered city club a saving of 27 per cent was made by installing automatic heat control. This was the result after the two seasons were equalized for outside temperature.

Of two similar office buildings, both metered, one having automatic heat control, the other without it, the automatic controlled building used an average of 556 pounds of steam per square foot of radiation, while the other used 894 pounds of steam per square foot of radiation, during four years, showing a saving of 38 per cent to be credited to the controlled building.

WALTER E. GILLHAM
CONSULTING ENGINEER
[illegible] BUILDING
KANSAS CITY, MO

June 22, 1923.

Johnson Service Co.,
City.

Attention Mr. F. A. Sheppard.

Dear Sirs-

I have your letter of June 21st asking my opinion regarding the saving qualities of automatic temperature regulation.

In the preparation of the plans and specifications for the heating of the Land Bank Building, 15 West 10th Str., this City, the question regarding temperature regulation was discussed and the Architects, Messrs. Keene & Simpson, requested me to get some data on the subject. Accordingly I investigated the cost of heating in four Kansas City buildings: the Chambers Building, 12th & Walnut, the Reliance Building, 10th & McGee, the Waldheim Building, 11th & Main, and the Rialto Building, 9th & Grand Ave.

The Chambers Building and the Rialto Building are equipped with automatic temperature regulation. All of the buildings, at the time the tests were made, were heated by the Kansas City District Heating Company and the following information was taken from data on file in the offices of this Company:

To heat these buildings, the following number of pounds of steam were required per thousand cu. ft. of space:

Chambers Bldg.	with	Temp. Regulation	--	3640#
Reliance "	without	"	"	--7200
Rialto "	with	"	"	--3500
Waldheim "	without	"	"	--6726

The cost per thousand cu. ft. of contents in the Chambers Building was $5.96. The cost per thousand cu. ft. of contents in the Reliance Building was $8.62 or 48% more than the Chambers Building.

The Reliance Building have, since this information was obtained, installed their own boiler plant, but I am of the opinion had they installed temperature regulation, they would still be buying their steam from the Kansas City Heating Company.

Trusting that this gives you the information you desire, I am

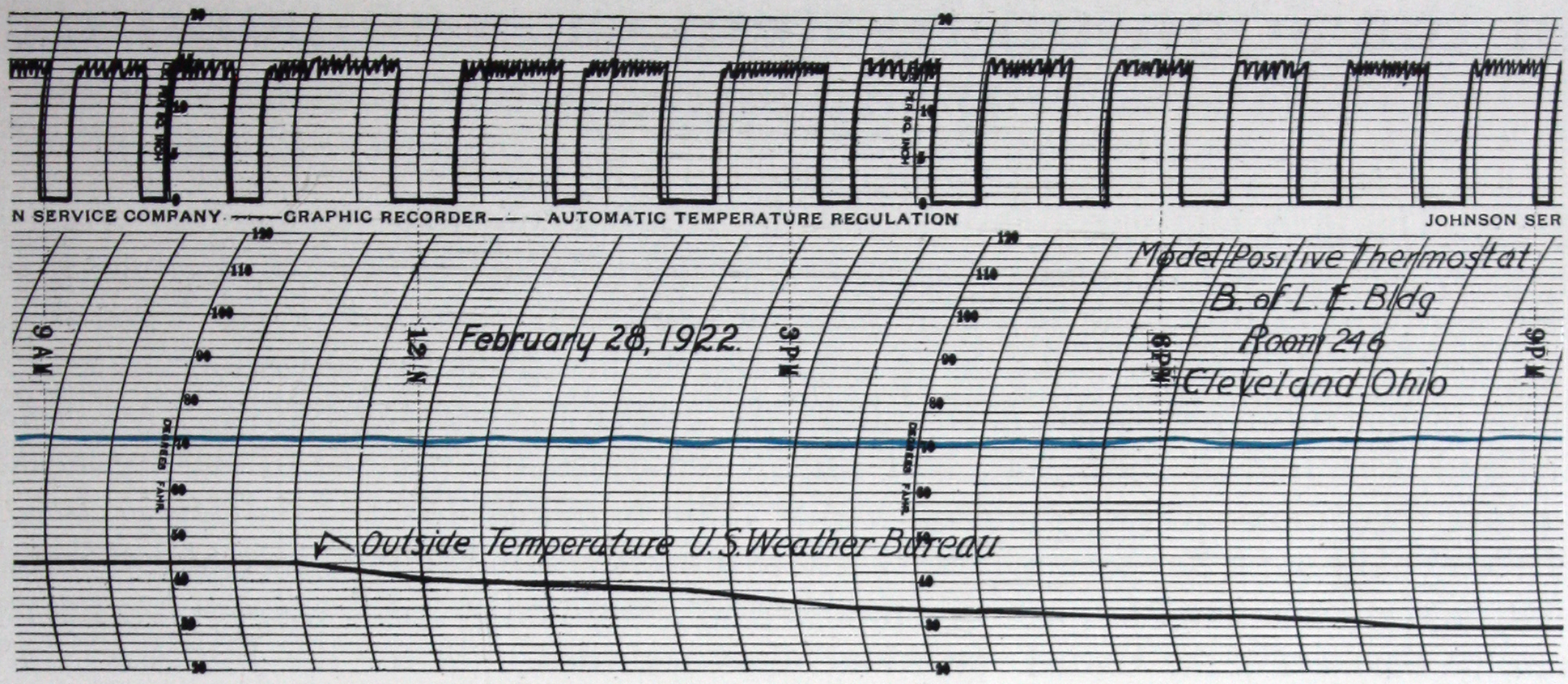
Very truly yours,

Walter E Gillham

WEG/FF.

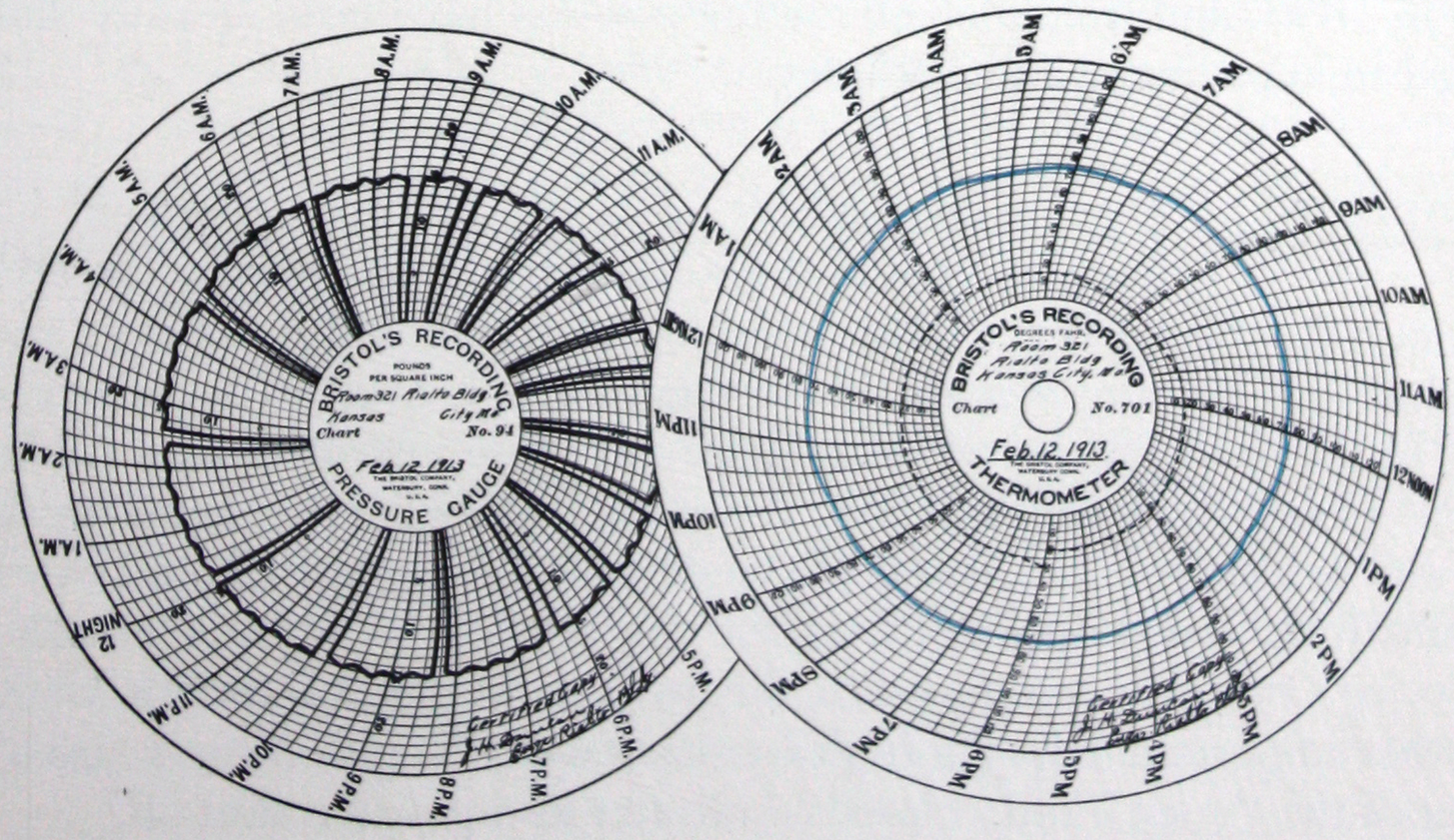
With such results as above I can not help but have a high regard for temperature regulation.

Charts Prove Johnson Efficiency



The recorded operation of the Johnson Pneumatic System of Temperature Control is shown on the accompanying illustrations. The reproduction of The Graphic Recorder Chart above shows the even steady 70° temperature maintained indoors, as indicated by the blue temperature line, in spite of the outdoor changes, as indicated by the lower black line. The jagged line at the top indicates when the radiator valves were closed, while the straight lines of the same section indicates when the valves were open. Twenty-four operations of the valves are recorded in a period of twelve hours. The valves were open for a period of four hours and closed eight hours, opening and closing on an average of once an hour.

The circular charts below indicate similar results, the temperatures being registered on the right hand chart and the operation of the valves on the left. In this instance, the valves operated thirty-two times in a twenty-four hour period, being open four hours and closed twenty hours.



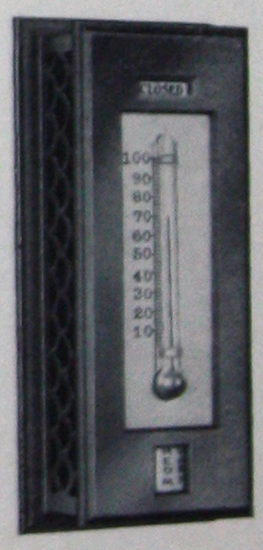
Brief Interesting History of the Johnson System of Temperature Regulation

Pioneer: The preceding pages have shown the value of automatic temperature regulation. This addition to human comfort and to social life and this source of economy is due primarily and principally to The JOHNSON SERVICE COMPANY. *Prof. Warren S. Johnson,* the first president of this company, was the inventor and the first person to suggest an apparatus for automatic temperature regulation. The JOHNSON SERVICE COMPANY, which *Prof. Johnson* founded and organized in 1885, has, ever since, been constantly devoted to making automatic temperature regulation successful and of infinite value to human life and industry. It has required a long time and it has been a difficult task to prove the value and the necessity of automatic temperature regulation, and to place this industry on a substantial basis where it has proved its worth in the business of the United States and other countries. While the JOHNSON SERVICE COMPANY has not been alone in the effort to do this, it was the originator of the idea, has borne the brunt of the battle, *and has been the leader in making the constant improvements which have made automatic temperature regulation the recognized success that it is today.*

1890.

Steps of Perfection: The apparatus originally placed upon the market was comparatively crude and many were the failures recorded against it. Some of them were due to faults in the apparatus and inexperience in installation, and people were not ready to recognize the merits of temperature control. One by one the faults were eliminated; one by one applications of the apparatus were made and it is largely due to the use of automatic regulation that the great strides and advancements have been made in the arts of heating, ventilating and humidification.

The apparatus was originally an electric and pneumatic combination, naturally complicated; but the use of electricity was eliminated by the Johnson Service Company in 1895, and from then on the thermostats have been steadily simplified and improved in appearance and efficiency.



1924.

Thermostat Improved: During the past 39 years the Johnson laboratory has been devoted to the work of trying to improve the thermostat. Today our thermostat is accurate, reliable, attractive in appearance, and, due to the fact that it is entirely *metallic* in its structure, it is practically indestructible from use. In the early process of manufacture of these instruments, a rubber diaphragm was necessary in its construction; it was the best element at hand for the purpose, but it was recognized that it was not as durable as was desired, and efforts were made to substitute something of metal for the rubber or organic element. The Johnson Service Company accomplished this with its Metal Diaphragm Model Thermostat. Other important Johnson improvements were the reduction in size of the thermostat and the invention of the "open" and "closed" indicator and positive shut-off.

Improved Valve: The same may be said in the improvement of the valves on the radiators. Obviously, in operating valves by means of compressed air, some kind of motor was necessary to utilize the power of the air. This motor was in form of a rubber diaphragm, which confined the compressed air and furnished the means of communicating the pressure of the air to the spindle and disc that operate the valve. Rubber was the best available and apparently the most desirable substance to be used; but it was known at that time that metal would be more durable, and a constant search was made for a metal diaphragm. It was not until 1914 that the seamless metal bellows called "Sylphon", which had been invented by W. M. Fulton, was so perfected that it could be approved as desirable in diaphragm valve motors; and the Johnson Service Company immediately adopted this improvement and put on the market the first successful metal bellows diaphragm valve.

1885.

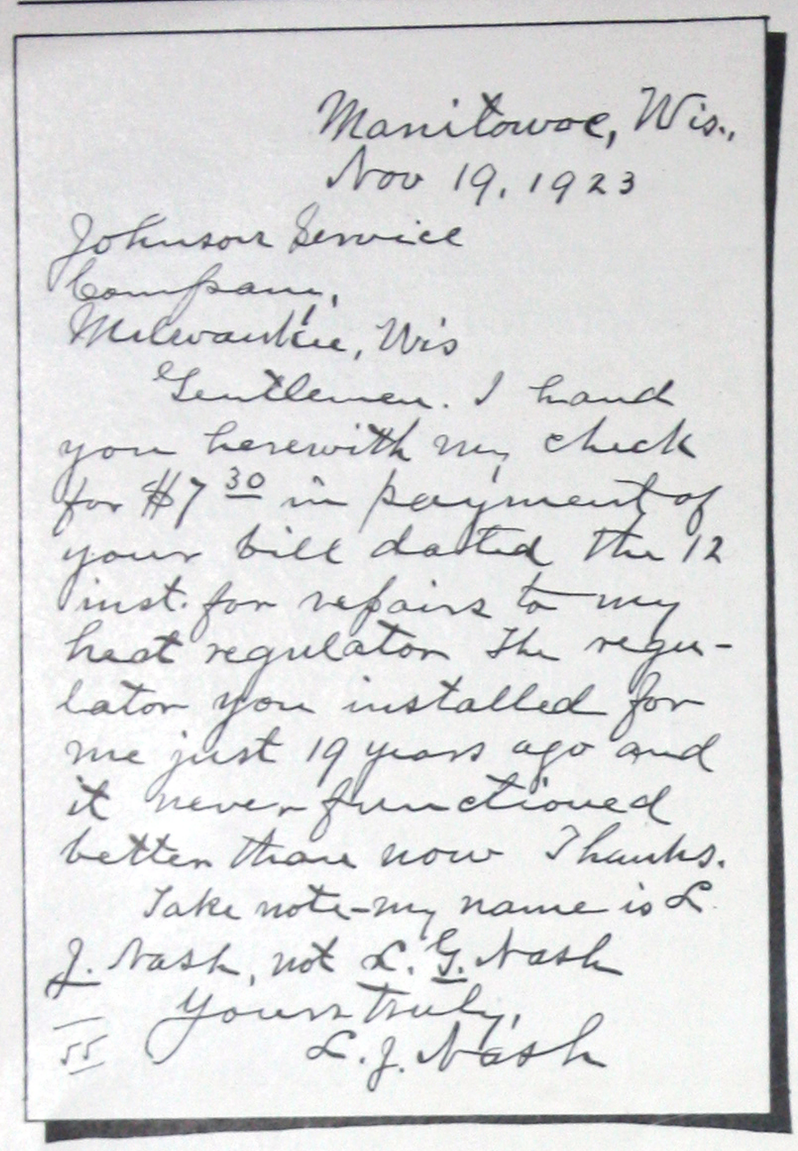
1924.

A Finely Drawn Policy Has Built This Business: All of this could not have been done without an organization and a fixed policy which has been adhered to from the inception of the company to the present date, and which will be adhered to as long as the company is in existence. It is a policy based on sound, honest principles, ever searching and alert to give the best that is possible, always striving toward perfection—as a necessary, practical solution as well as an ideal. Our policy has been one that strives to make satisfied customers, with the result that our business has grown and the number of installations of our apparatus has increased because of the commendation of those who have experienced the benefits derived from the use of the JOHNSON SYSTEM.

Johnson Quality and Reliability: We have endeavored as far as possible to make the best apparatus of this kind that could be made. As stated in the previous paragraph, we have constantly striven to improve the efficiency of the apparatus, by improving the design, by eliminating unnecessary parts, by making the apparatus with machinery that is being constantly improved for that purpose, and by thoroughly testing every completed part for the service it is to perform. It has been our policy always to use the very best material obtainable in the manufacture of our products. In this policy there has been no change since the beginning of the business. The highest quality of material necessary for the apparatus has been purchased regardless of price. We have occasionally been deceived in our purchases and the material we bought was not up to our standard; but in all such cases we have shouldered whatever loss occurred and replaced the apparatus whenever we found that the material seemed to be beneath our recognized standard of quality.

Apparatus Thoroughly Tested: None of the principal parts of the Johnson System of Regulation leaves the factory without going through a thorough test for efficiency and durability. Thermostats are tested for accuracy and close degree in operation. Valves are tested as to their steam holding qualities. Air compressors are tested for capacity and efficiency of operation.

Later in the book will appear illustrations and descriptions of the elaborate testing rooms and methods.



Manitowoc, Wis.,
Nov 19, 1923

Johnson Service
Company,
Milwaukee, Wis

Gentlemen. I hand you herewith my check for $7.30 in payment of your bill dated the 12 inst. for repairs to my heat regulator. The regulator you installed for me just 19 years ago and it never functioned better than now. Thanks.

Take note-my name is L. J. Nash, not L. G. Nash

Yours truly,
L. J. Nash

How Johnson Company Maintains Installations: We have endeavored also to improve our apparatus for the purpose of reducing the necessity of repairs. It is inconceivable that a machine shall continue to work forever without requiring repairs; nobody expects it. Machinery has wearing parts and will wear out, but it has been our endeavor to reduce these wearing parts to a minimum and to make the wearing parts of such material and of such construction that they will give long service. We do this in the interests of our customers as well as in our own interests. The less repair work we are called upon to do the better we are satisfied. We have never attempted to make profit out of our repair work. To assist our customers we endeavor to inspect all of our installations once each year for the purpose of ascertaining their condition and then report to the owners whether or not repairs are necessary. We make no charge for this inspection: such repairs as are necessary we make at as reasonable a price as possible.

All Apparatus Installed by Our Own Men: To insure the best results to our customers we do not under any circumstances sell our apparatus to be installed by any but our own mechanics. We have been in business since 1885 and have installed thousands of plants. There are thousands of engineers and mechanics in the United States who know all about temperature regulation and how to install it. Nevertheless we feel that no one will assume the responsibility and feel the same towards the plants that have been installed as we do. Should apparatus be sold to other contractors to be installed by them, there is always a possibility that the responsibility will cease when the plant is installed and the transaction closed. There is always the possibility of changes or even the passing out of existence of these concerns. Naturally, the manufacturer is not going to feel the same about looking after apparatus that was installed by other parties as he will towards apparatus installed by himself. The temperature regulating apparatus may last for the lifetime of a building, possibly twenty-five years or more, and in that time a great many changes will take place in the business world; but the Johnson Service Company will be in existence and will take the same interest in the plant that is twenty-five years old as in its most recent installation.

The Co-Operation Given the Owner, Architect, Contractor: When we are given a contract we execute that contract promptly and completely, as far as it is humanly and mechanically possible, to the satisfaction of the owner and the architect. It is our policy in doing business with other contractors to deliver promptly the material that is required in the construction of our equipment, so as not to cause delay to anyone. It is our practice to furnish the labor necessary to connect up the various parts of our apparatus promptly and correctly, at such time as will not interfere with other contractors, providing a fin-

ished installation when the building is completed. It is worth money to any contractor to know that this very important part of his contract will require no further attention from him, because the Johnson Service Company will do the work promptly and efficiently.

The Broad Extent of Johnson Service Organization:

To become leaders in the field of automatic temperature regulation has required an efficient organization. This organization is composed of many small units. First, there is the factory located in Milwaukee, Wisconsin, a seven-story, brick, steel and concrete building, having a floor space of 150,000 square feet and containing the very latest and best machinery obtainable for manufacturing the product and the most complete equipment for testing it. The main offices are also located in this building, together with the headquarters for the executives of the company. Here our engineers have their experimental and testing laboratories; it is the place where all the problems come to be finally solved, and it is the place where new ideas are delivered by our outside engineers and their requirements for new apparatus developed.

CHICAGO OFFICE, STOCK ROOM AND SHOP ON WASHINGTON BOULEVARD.

Building and Land, 60 x 175 Feet, Owned by the Company.

30 Johnson Branches—United States and Canada:

Next, we have branch offices located in most of the larger cities of the United States. These branch offices are entirely under the control of the main office. They are not manufacturers' agents, or jobbers, or salesmen maintained on a commission basis in any way whatsoever. They are organizations with a manager, a sales engineer, a superintendent of construction, inspectors and mechanics for installing the apparatus, stenographers and bookkeepers for handling the clerical work of the office; each and every one is paid a salary and works exclusively for the Johnson Service Company.

Every office carries a stock of parts and necessary material to install a plant or to repair any apparatus, and each office holds itself in readiness to give service on the shortest possible notice.

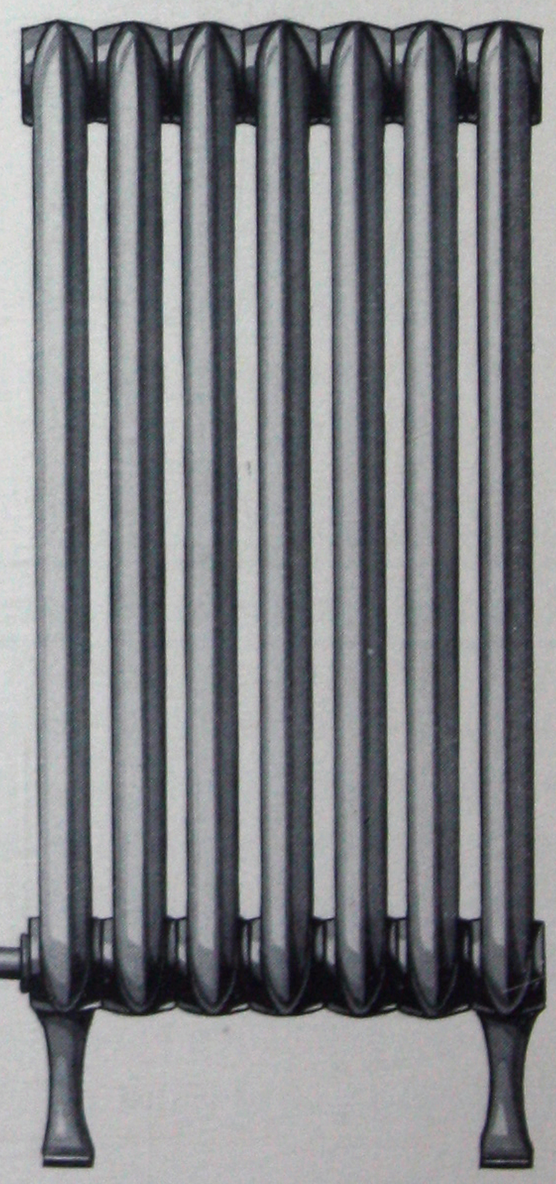
The Johnson Automatic Temperature Regulation System

BRIEFLY, THE JOHNSON SYSTEM OF TEMPERATURE CONTROL consists of a thermostat and a diaphragm operated valve or damper for each unit to be controlled and an air compressor, all completely connected by a system of small, concealed, compressed air piping. Apparatus which automatically operates a valve or damper on heat sources for the purpose of obtaining a uniform temperature, must be responsive to slight changes in temperature and powerful in its action. In the Johnson System, air at fifteen pounds pressure per square inch is used. It is obtained by a small, automatic air compressor driven by electricity, steam or water, and the cost of operation per unit of regulation is insignificant. Professor W. S. Johnson, the inventor of the Johnson System, adopted air under pressure as the most suitable power for this purpose; it is easily and cheaply obtained; it will close and hold valves of any size tightly against pressure; and it will move any sized damper easily and in a positive manner.

The most important part of a temperature control system is the thermostat. The sensitive element of the Johnson Room Thermostat is a bimetallic bar, affected by the rise and fall of temperature. Many years of experience have proved this to be the only practical and reliable sensitive element; it is the only absolutely durable and unchangeable element known for the purpose, and it is the most sensitive to slight and rapid changes in temperature, at the same time being insusceptible to any influence but temperature changes. The thermostat is constructed entirely of metal, having no soft or hard rubber parts or volatile fluid discs to deteriorate. A description of the design and application of thermostats for every purpose appears in the following pages.

Model Positive Thermostat.

The other important parts of the system are the valves, dampers, damper motors, switches and air compressors. These are all manufactured by this company out of the very best materials with the same care and precision as the thermostats. A full description with illustrations of these various appliances and their application will be found in the following pages.



It is as important that compressed air piping connecting the thermostats and valves with the compressing plant be installed properly as that the instruments be efficient and durable. The Johnson Service Company has developed a policy and followed a practice to install the entire system, including the piping, with its own mechanics, as the only means of insuring the user the most satisfactory operation of the apparatus, including the service, which a contract with this company always provides. We sell our pneumatic apparatus only when installed by our own mechanics and under our own supervision.

Johnson Thermostats and Humidostats

The thermostats and humidostats manufactured by the Johnson Service Company are of two general classes—pneumatic and electric. The pneumatic thermostats are manufactured in many types and patterns as required for the various locations in which they are installed and the uses to which they are applied. These thermostats and humidostats are always sold through a contract with the Johnson Service Company. All the labor and material for the installation is furnished from its own organization and the guarantee is maintained by the company itself. *This should be a part of all contracts for systems of automatic temperature regulation.* We have found that this policy which we have always followed is the only one that insures the purchaser complete satisfaction When temperature regulation apparatus is installed by others than the manufacturer, the loss of contact between the manufacturer of the system and the operator of the system always has unfortunate results.

Contractors and others who may purchase pneumatic temperature control apparatus with the intention of installing it themselves, may be sincere in their desire to give the owner complete satisfaction. However, such contractors are not continually doing this type of work and have not in their employ mechanics who are skilled in the installation of this apparatus as are the mechanics who have been employed for years by the Johnson Service Company. It is only natural that those who are not connected day after day with this particular part of a heating and ventilating system, will not have the same interest in the work as the manufacturer. Our sole business is to manufacture and install the apparatus, on the success of which our welfare depends. It is possible, also, that firms who attempt to install temperature regulation equipment may change or go out of business through death, failure, or other reasons, resulting in the discontinuance of service and annulment of the guarantee. The Johnson Service Company, having been in this business exclusively since 1885, is a permanent institution, and any plant installed by this company is sure of service and attention as long as the plant exists.

Two Principal Classes of Pneumatic Thermostats

Pneumatic thermostats are divided into two principal classes—first, those that are installed within the rooms for the control of the heating appliances and temperature in rooms, commonly called room thermostats: second, those that are inserted through walls into rooms, ducts, tanks and other similar receptacles and plenum chambers, where it is impracticable or inadvisable to locate the working parts of the thermostat. The latter are commonly called inserted thermostats.

The movements or mechanical parts of thermostats are made in two forms: in one of which the action is positive and quick, opening and closing a damper or valve entirely and positively in a few seconds—called a positive thermostat. In the other the action of the thermostat is to open and close or partially open and close a valve or damper gradually, holding at times the damper or valve partially open so as to admit the necessary heat required to maintain the required temperature. These thermostats are usually called intermediate thermostats.

Electric Thermostats.

The company also manufactures a full line of electric thermostats of both the room and the inserted type. These thermostats are sold outright to the purchaser and the company does not insist on making the installation, but will do so if desired. Johnson Electric thermostats are without an equal as a means for operating electric motors for refrigerating purposes or electric heaters for incubators, laboratories, etc.

Room Temperature Control

There are three different types of room thermostats and the kind to be selected depends on the method of heating and ventilating. They are the positive, or quick acting thermostat; the intermediate, or graduated acting thermostat; and the combination or compound thermostat.

Modern rooms are heated by one of the following five general methods of heating:

First—Direct steam, vapor, or hot water—radiation.
Second—Furnace, gravity and blast.
Third—Indirect steam, gravity and blast.
Fourth—Combinations of blast systems and direct radiation.
Fifth—Unit ventilating and heating systems.

Positive thermostats are generally used in connection with direct radiation, for the positive and complete opening and closing of radiator valves. On gravity, one pipe, steam heating systems positive operation of the valves is required to prevent water hammering and other annoyances; for these cases the positive thermostat is necessary for the proper automatic operation of the valves. On vacuum systems where the steam enters the radiator at one end and the water of condensation returns at the other end, known as the two pipe, wet return, vacuum system, the controlling valves can be operated intermediately, and it is a matter of opinion as to which thermostat is preferable. There are obvious reasons why the positive thermostat is preferable, among which are prevention of damage to valve seat or disc through accumulation of scale on the seat or wire drawing caused by fractional opening of the valve. Positive thermostats can be fitted with an indicating device showing whether the steam is turned on or off; it is quite a desirable feature in connection with automatic temperature regulation. The intermediate thermostat operates in such a way as to admit only the amount of steam into the radiator necessary to maintain the temperature of the room, which some engineers believe is a very desirable method.

The Johnson Service Company, upon request, will supply information concerning the type of thermostat best adapted for use in specific cases, and will furnish either the positive or intermediate thermostat for use on radiators as selected by the owner, architect or engineer. The thermostats are guaranteed to operate the radiator valves in an accurate manner, and control the temperature of the room, in so far as the temperature is affected by the particular radiators controlled, on a temperature variation at the instruments of one degree above or below the point at which they are set.

The intermediate thermostat is used in all cases of hot air heating where the admission of hot air is controlled by a double damper which either permits heated air to enter the room or a mixture of heated air and cool air commonly known as tempered air.

The compound thermostat is a combination of the positive and intermediate instruments, being in reality an intermediate and positive thermostat on one base operating to control the direct radiation positively and the indirect or hot air part of the system intermediately. These thermostats may be arranged so that they will cut out the direct radiation first and turn it on last or cut out the hot air ventilation first and turn it on last.

Either compound thermostats or intermediate thermostats are used in connection with the unit heating and ventilating systems controlling the damper motor and radiator valve on the cabinet heater, also the valves on the supplementary radiators.

Johnson Room Thermostats are Artistic and Efficient

The Johnson room thermostats are models of perfection and works of art. The thermostatic element of the Johnson room thermostats has always been a compound metallic bar which has proven by use and experience to be the most durable and reliable thermostatic element yet found. The pneumatic bimetallic thermostat was first put on the market in 1895. In general principle the same thermostat is used today, but it has been greatly changed in size and construction so that at present it is the most perfect and reliable thermostat on the market. While the basic principles of this thermostat have not been changed, every part of the instrument has been improved in some detail. Unnecessary parts have been eliminated and imperfect parts have been perfected; materials that were not durable have been replaced by durable material. Every superfluous spring has been taken out and any part that we found through use and experience to be a possible cause of inefficiency has been changed. It would be too long a story to go into all of these minute details, but we will call your attention to the important changes which have been made.

We made the change in size from an instrument which was 10″ long and 3″ wide to one that is only 5″ long and 2″ wide. The thermostat which had been considered by architects as a hideous but necessary fixture in a room, was converted into a model of beauty. In changing the size, many small improvements were made in the mechanism.

Diaphragm of Metal

The most noticeable of these changes in the mechanism was the metal diaphragm, making the instrument truly an all metal thermostat. At the present time this thermostat has no organic parts that will deteriorate or lose their coefficient of expansion nor liquids or gases that may deteriorate and escape. Other important additions and changes to this thermostat are the "open" and "closed" indicator, the positive shut-off, the restricted adjustment and the key adjustment.

Shows at a Glance Whether Valve or Damper is Open or Closed

The "open" and "closed" indicator is a wonderful and desirable addition to the thermostat. It is a small plate located at the top of the thermostat and observed through a rectangular aperture which displays either the word "open" or "closed", so that the occupant of the room can easily tell by glancing at the thermostat whether the steam valve or damper that controls the heat of the room is open or closed.

The Positive Shut-Off a Bed-Room Feature

The positive shut-off is a device whereby a thermostat can be thrown out of commission, keeping the radiator valves closed. No change of temperature will open the radiator valves until the thermostat is again put into commission. This particular device is extremely desirable and useful in bedrooms where the windows are open all night and where, if the radiators are turned on, heat would be wasted.

Positively Protected from Mishandling

The adjustment of the thermostat is of considerable importance. There are places such as school buildings, particularly, where it is desired that no one in the building shall be able to adjust the thermostat except the engineer or some person in authority. For such buildings, thermostats are made that do not permit the changing of the adjustment except by removing the cover, which can be done only by the one authorized. Thermostats in schools are usually permanently set at a fixed temperature, generally seventy degrees. There are other buildings like hospitals where it is necessary that the adjustment of the thermostat shall be changed with more or less frequency; but it is not desirable that any one except the doctor, nurse or engineer, or those in authority shall change the thermostat. For these thermostats a key is provided with which the adjustment can be changed, and the patient or other person cannot change the adjustment without a key.

Others for Residences, Adjustable at Will

In residences, for example, it is frequently desirable in some instances that the temperature be different in various parts of the building. For such cases, thermostats are provided, if desired, with the full dial adjustment which permits any thermostat to be instantly set at any desired temperature. With this arrangement, the temperature in any room can be changed several times a day at will, permitting the temperature of a sick-room to be kept higher than normal, and the temperature of bath-rooms to be changed to meet various needs.

Restricted Thermostat Adjustment for Office Buildings and Hotels

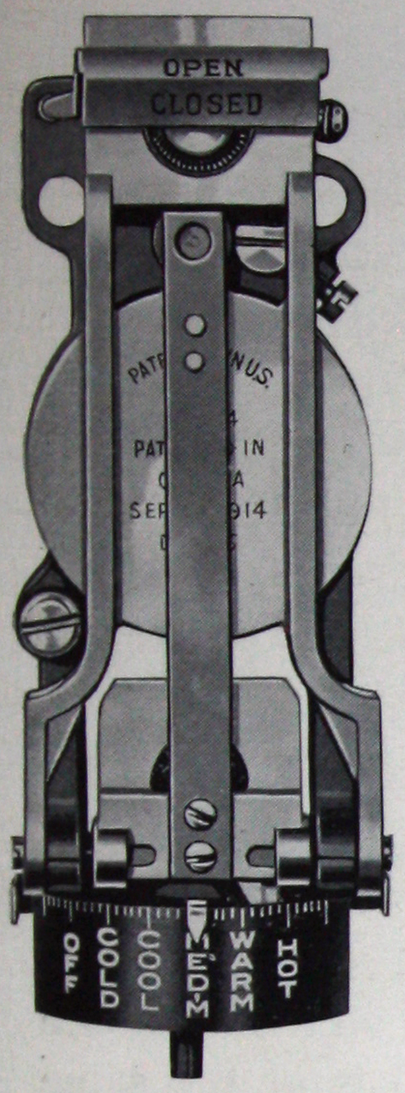
For office buildings we have provided the restricted adjustment. Thermostats are installed in office buildings as much for the economy in fuel consumption as for the comfort of the occupants, and if these thermostats are adjusted by the occupant to control at anywhere from 60 to 80 degrees, the object of economy is not obtained; neither is comfort in the office maintained. The restricted adjustment enables the occupant to change the setting of dial of the thermostat about six degrees, but not beyond these points; makes it possible for the thermostat to meet the desires of the various occupants of the building, and at the same time effects the economy in fuel which is one of the functions of temperature regulation.

For hotels we have provided the restricted adjustment thermostat with an easily operated positive shut-off, enabling the occupant of the room to turn the heat off completely, and if he desires, to maintain any temperature within a range of four or five degres when the heat is used.

Restricted adjustment thermostats are either positive-acting or graduated-acting as desired and are interchangeable where either is preferred.

Remote Adjustment

With this very remarkable device, the engineer can change the adjustment of thermostats previously designated by merely pushing a button. It is of special use in schoolhouses where certain rooms are used at night and, of course, require the same temperature as during the day, and certain other rooms not being occupied can be kept at a lower temperature and save fuel. It is also desirable for churches, temples, auditoriums and halls that are not constantly in use, as it enables the engineer, without extra work, to shut the heat off or reduce it to a low point when these buildings are not in use and restore it to normal conditions when they are placed in use.



All Metal Positive Thermostat.

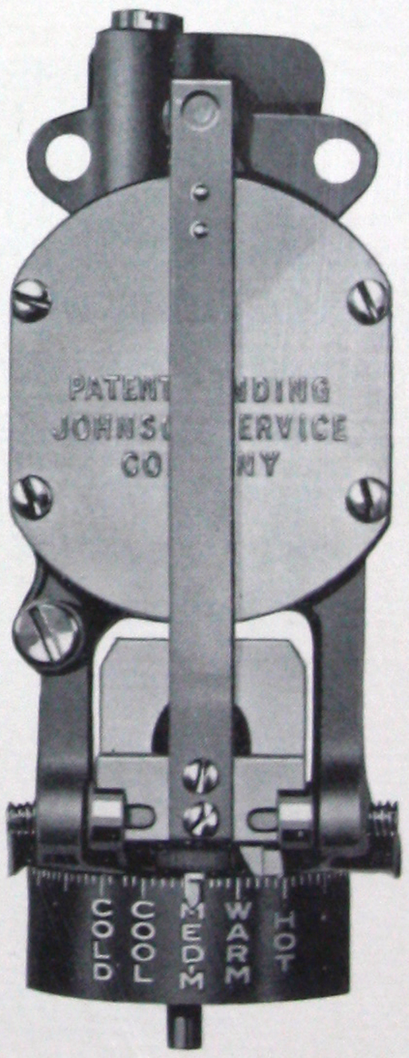
Johnson Positive Model Thermostat

As indicated by the name the Johnson model positive thermostat is a quick acting instrument. It is necessary that valves on certain kinds of heating plants should open and close positively and quickly, as otherwise disagreeable and dangerous conditions would arise. If the valve on a gravity one pipe system of heating is not closed tightly and quickly, steam will still continue to enter the radiator in small quantities, but the water of condensation will be unable to pass out, with the result that the temperature will not be controlled, and disagreeable noise known as "water hammer" will occur in the radiator and piping system when the valve is again opened. Where high pressure is used and the valve is not closed entirely and quickly, the steam passing through a very small opening is liable to cut the valve seat, causing it to leak and deteriorate. These are some of the conditions of operation where a quick acting or positive thermostat is absolutely necessary. There are many other reasons.

The features in a thermostat covering snap action, quick action and positive action which will open and close the valve entirely within two or three seconds from the start of the movement are very hard to obtain, but the Johnson Positive Thermostat has solved this problem perfectly. It does not depend on uncontrolled leaks in the air piping or in the thermostat to produce these results.

Johnson Intermediate Thermostat

As indicated by the name, this is a graduated acting thermostat which opens and closes dampers or valves slowly or gradually and holds them partially open or partially closed for a long or short period, as conditions require. The Johnson Model Intermediate Thermostat is necessary and desirable in connection with certain forms of heating and ventilating; with the central plenum system, where both the heating and ventilating are done by heated air it is quite commonly used. The success of the plenum system depends on the operation of a double damper which admits either warmed air from one source, or tempered air from another source, or probably and generally a mixture of the warmed and the tempered air into the duct leading to the controlled room, keeping it at the desired temperature without disagreeable sensations of draft. The graduated or intermediate thermostat meets these requirements, operating the warmed air and tempered air blades of the mixing damper admitting a constant volume of air at a proper and uniform degree to maintain the desired temperature. It is obvious that the graduated thermostat is the most desirable instrument to use in connection with the plenum system of heating and ventilating. In hot water and vapor heating systems it is possible to maintain the temperature of the room by admitting to the radiators only such an amount of



All Metal Intermediate Thermostat.

water or vapor as will balance the loss in the temperature of the room through the walls from natural causes. The graduated acting thermostat is therefore desirable in certain specific instances.

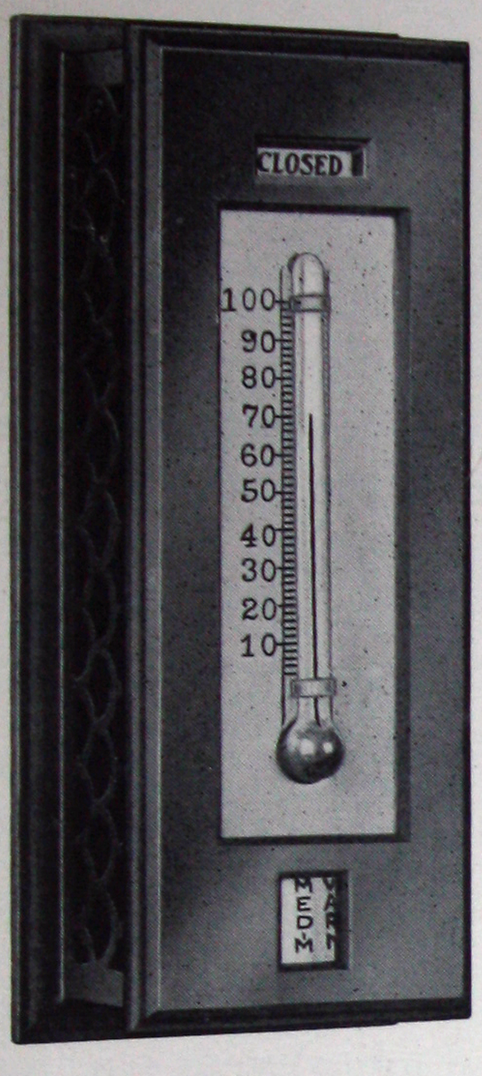
We will say right here that the Johnson Service Company takes no decided stand on the merits of the positive acting or the intermediate acting thermostat for hot water, vapor, or vacuum heating systems; the choice depends upon conditions of design and operation; but, as the results in these cases are practically the same, the Johnson Service Company is willing and prepared to furnish either type.

On Market Many Years

The Johnson intermediate graduated acting thermostat has been on the market since 1906, and has been installed in thousands of buildings where it has given perfect satisfaction. During this time the instrument has been greatly improved; but the vital principle, that of a bimetallic, thermostatic strip, actuating a reducing valve which is the only true principle of an intermediate thermostat, has been constantly in use. The Intermediate thermostat now used is of the same size as the positive thermostat, and like the positive thermostat is constructed entirely of metal. It has no rubber or leather diaphragms whatever. It is absolutely and entirely metallic in construction and has at the same time all the means and methods of adjustment of the positive thermostat. The Johnson Intermediate thermostat gives the true gradual motion to dampers and valves.

How Intermediate Thermostat Operates

The intermediate thermostat operates the mixing damper by means of compressed air in the manner outlined above. The thermostat automatically varies the pressure of the compressed air supplied to the diaphragm operating the mixing damper proportionately to the variation of temperature in the room or chamber. If the temperature at the thermostat rises very slightly above the point at which it is set, the air pressure in the diaphragm on the mixing damper will increase slightly, causing the damper to deliver cooler air to the room. If the temperature at the thermostat decreases slightly, the reverse action takes place, and warmer air is delivered to the room. The bi-metal thermostatic bar shown in the center of the thermostat operates a small pressure regulating valve to accomplish this purpose. The thermostatic strip is thin and therefore responds readily to the slightest change of temperature.



Model RI Cover.

Johnson Thermostat Covers

The size and appearance of room thermostats are obviously of importance. The Johnson model thermostats are the smallest made, the covers being only 5″ x 2″ x 1¼″. They are designed to harmonize with the appointments of any kind of room, and are made in two patterns designated by R and P.

The R pattern, designed for us by one of the leading architects in the United States, is a handsome instrument intended for the larger and more pretentious rooms in hotels, residences, theatres, public buildings, banks and handsomely furnished offices.

The P pattern is a plain and simple design intended for offices, schools, hospitals, residences and in fact, any room except those in which the R pattern would be more appropriate. It is desirable because of its simplicity; many architects prefer it to the R pattern for all rooms.

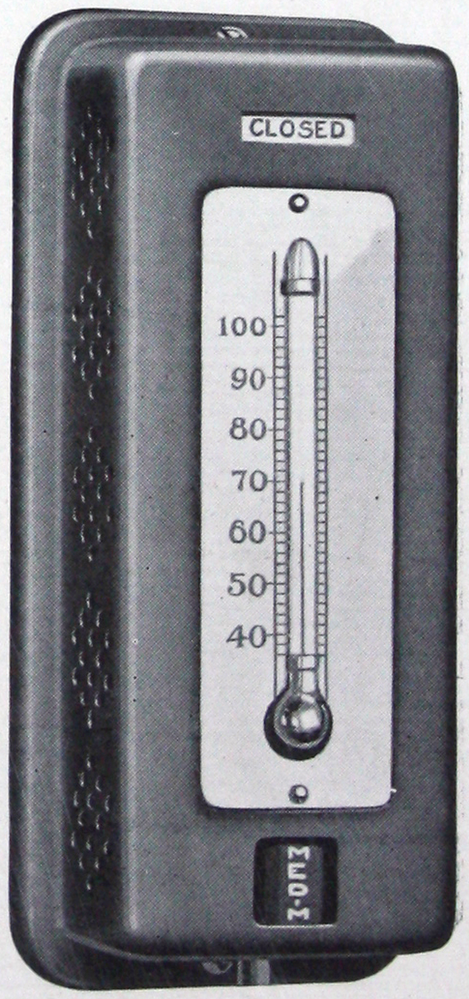
Space does not permit us to describe or illustrate all of the great variety of thermostat covers made by us, but the following is a description of those commonly used.

Model RI Cover The RI pattern, sometimes called a residence cover, having "open" and "closed" indicator, exposed dial and knob adjustment, is generally specified for the larger and more pretentious rooms of residences, court-houses, hotels and banks where heating is by direct radiation and positive thermostats are used.

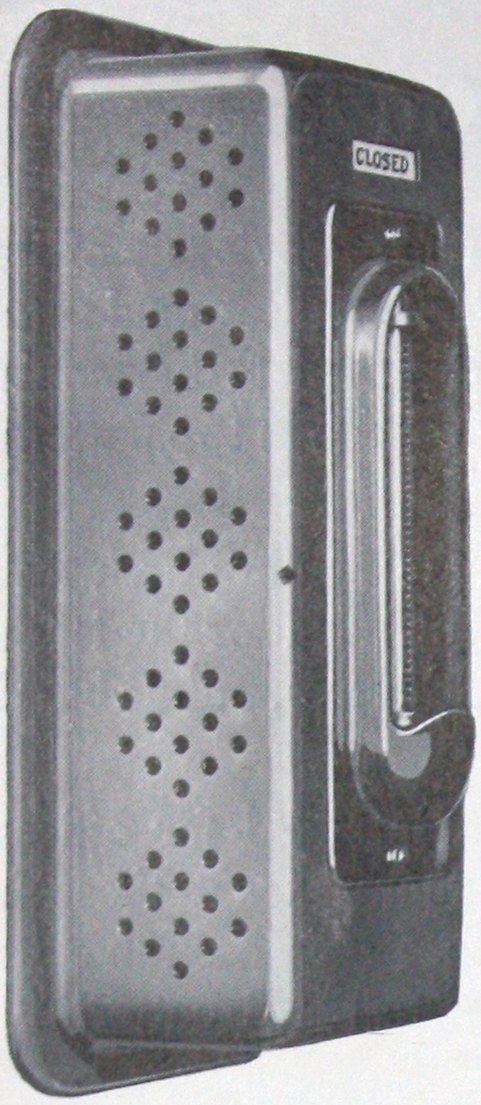
Model R Cover The R pattern is the same as the residence cover, but without "open" and "closed" indicator. It is used in the same locations as the RI cover, but in connection with intermediate thermostats.

Both the R and RI covers are also made with closed dial and key adjustment for use in rooms where it is desired that the adjustment cannot be altered by anyone except some person in authority. Other modifications are made in both styles to meet conditions that may be presented.

Model PI Cover The PI pattern, having "open" and "closed" indicator, with exposed dial and knob adjustment, is generally specified for rooms heated by direct radiation and controlled by positive thermostats, where it is desirous that changes in the adjustment may be made at the pleasure of the occupant.



Model PI Cover.

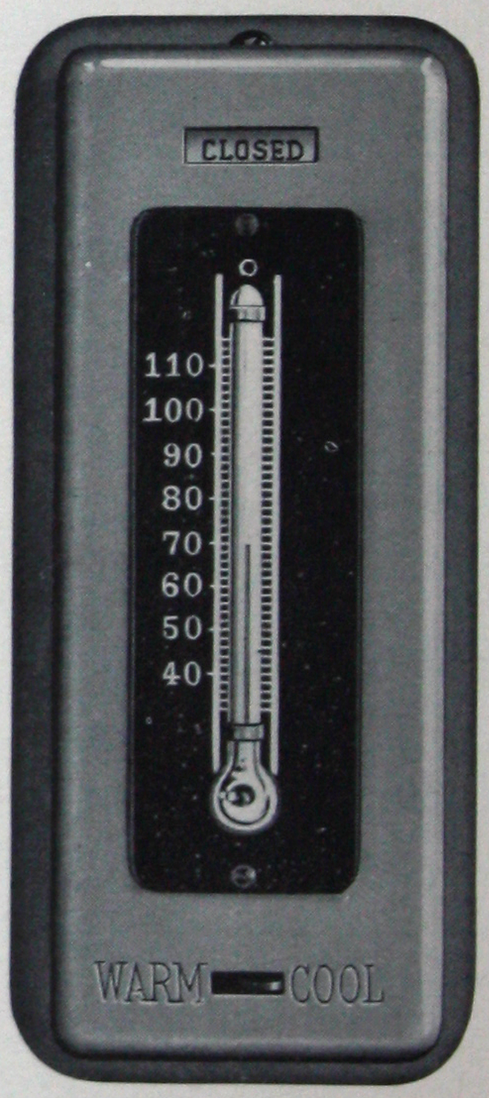


Model PSI Cover.

Model P Covers The Model P cover is made without "open" and "closed" indicator; it is used in the same locations, but with intermediate thermostats. These handsome, clean cut, pressed brass covers are adaptable for thermostats on any installation, but are particularly well suited for use in offices, public buildings, hospitals, and less important rooms of residences. The indicator thermostat should always be used if possible; it enables the occupant of the room to determine at a glance whether the heat is turned on or off.

School Thermostat Covers The Model PI and Model P covers previously described can be used in schools, but it is generally desired that the covers of thermostats in schools be so designed that the adjustment of the thermostat can not be made by anyone except those in charge of the apparatus. For this purpose we have the Model PSI for positive thermostats and the Model PS for intermediate thermostats with the dial and adjustment opening omitted. These covers are made in any of the standard finishes, but the baked Japan finish or the Bower-Barff finish has proven the most serviceable in schools. The thermometer is protected by a guard to prevent damage by mischievous pupils.

PLI and PL Covers This is a P pattern cover similar to the P and PI covers, except in the arrangement of dial and adjustment. The dial opening is closed and instead of knob or key adjustment, there is a small lever projecting through the front at the bottom of the thermometer, which will enable the occupant to change, to a limited extent, the degree of temperature at which the thermostat is to operate. When the lever is pushed to the left side, the thermostat will operate at about six degrees higher temperature than when it is pushed to the extreme right side. The PLI cover enables one to secure a cool or warm temperature over a 6 degree range as desired; it is made for an indicator thermostat that should, for obvious reasons, be used wherever possible. This form of cover is very popular for offices; it enables the occupant to change the temperature to a limited extent and avoids the extreme variations in temperatures which are often produced by neglecting the setting of the thermostat dial.



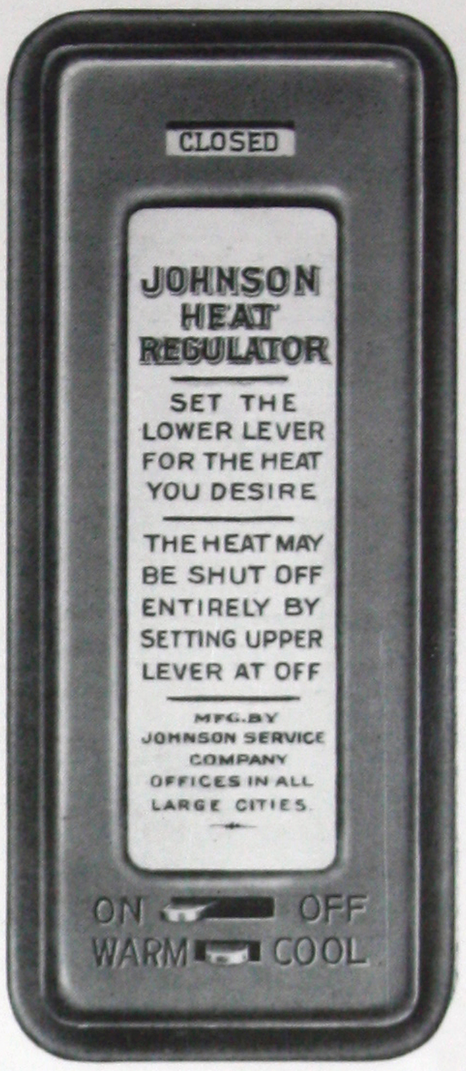
Model PLI Cover.

Johnson Hotel Thermostat

The ideal cover for a hotel thermostat is shown on the next page. It is a PLI cover with an additional lever permitting the occupant to shut the heat off entirely when desired. By moving the lower lever, the occupant can set the thermostat for whatever temperature desired, within certain limits, and by moving the upper lever, can turn the heat off when the windows are open at

night and turn it on again in the morning. The indicator informs the guest whether the heat is "on" or "off" and is a feature which will be greatly appreciated by the traveling public, especially when the radiators are concealed in boxes under the windows.

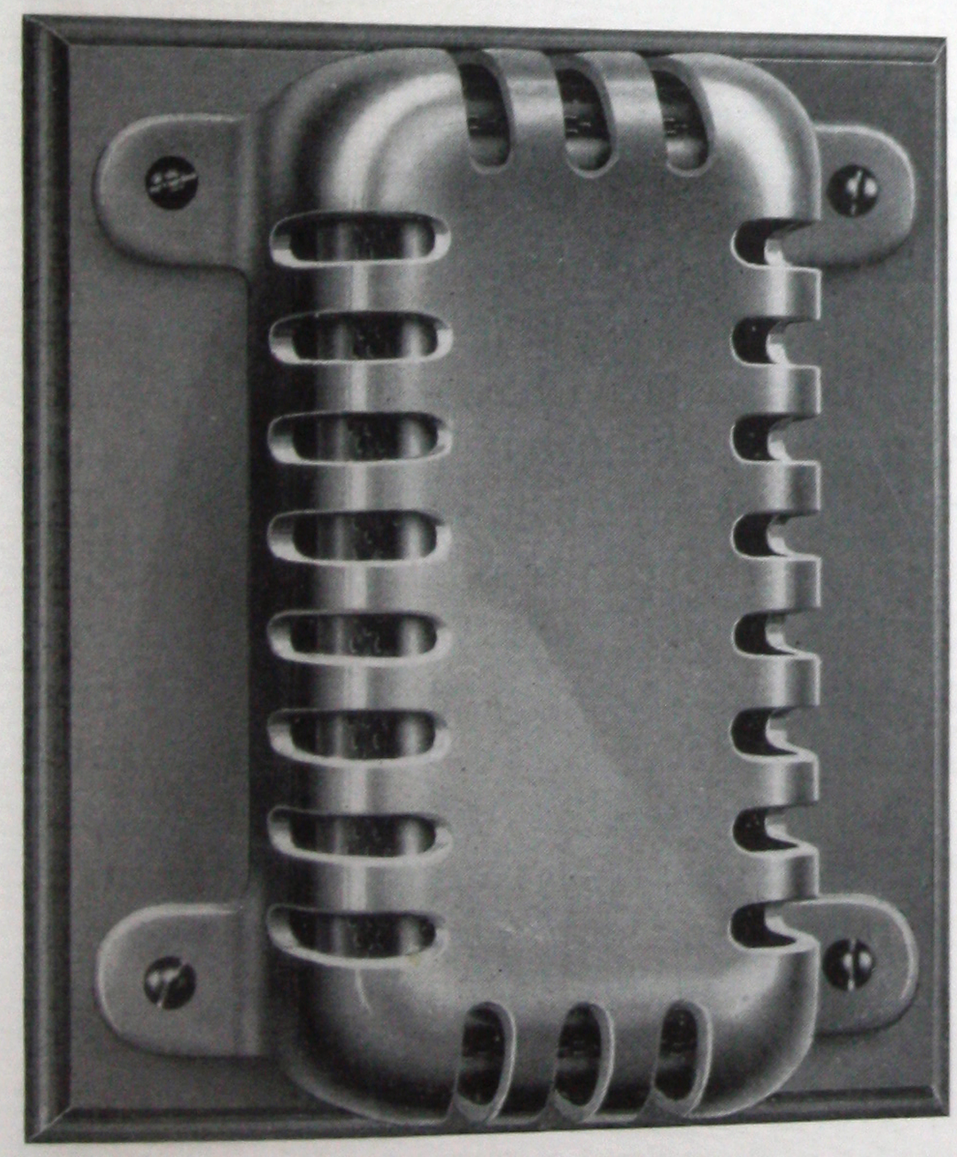
Automatic temperature regulation not only provides ideal conditions of comfort for hotel guests, but is of great economical value to the owners of the hotel. It saves greatly in the cost of operating the heating plant, and the Johnson System, with its many advantages, will save money for the owner. With the ready means of shutting off the heat, described above, the owner will have much greater assurance of the heat being shut off from unoccupied rooms by employees than would be the case where hand control of the radiators is provided. With hand control, guests will not open the valves fully when turning on the heat, nor shut them tightly when turning the heat off, with the result that the hand valves soon become leaky through the wire drawing of the steam and cutting of the valve seat. Johnson Positive Thermostats hold the valves either "open" or "closed"; the carelessness of guests in this respect is eliminated.



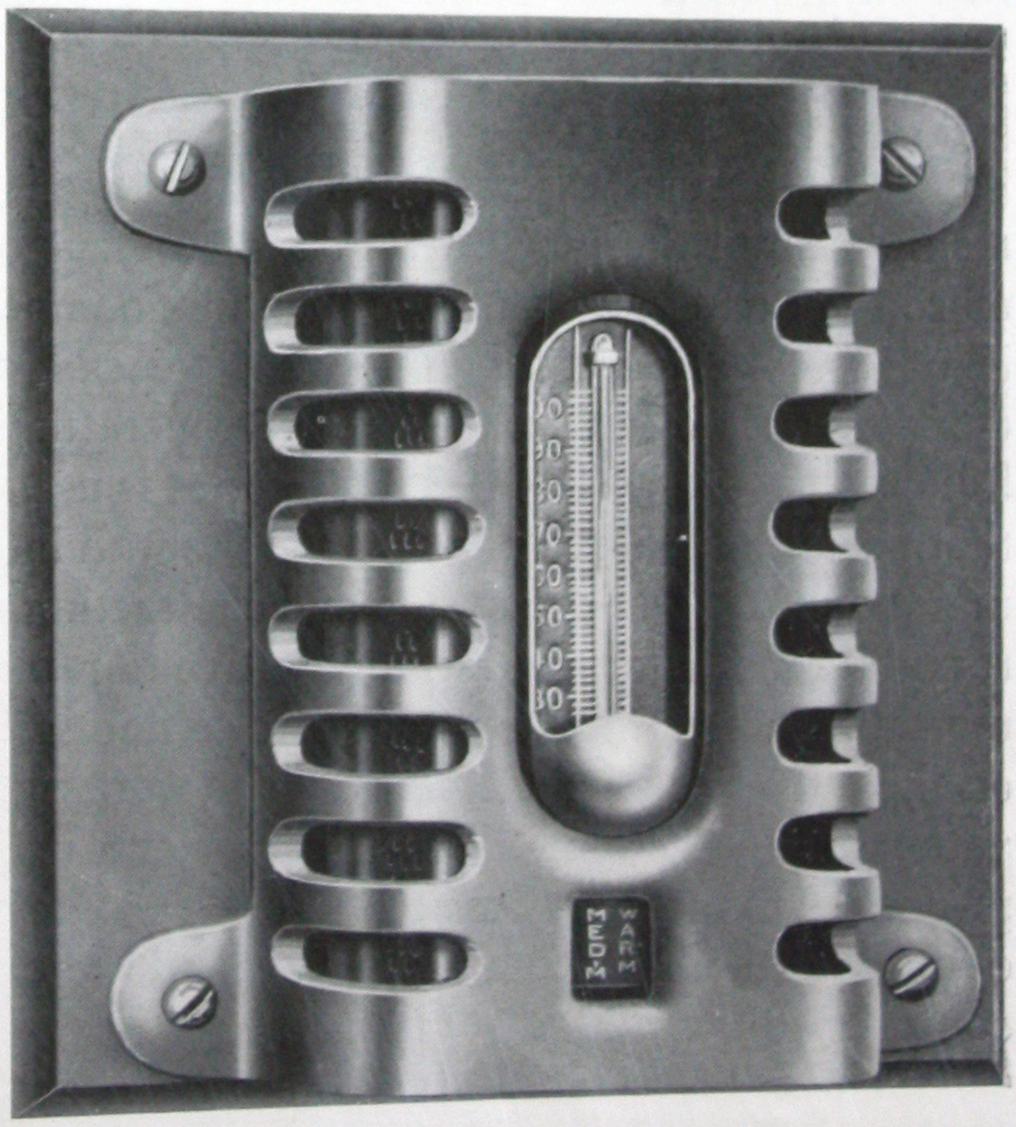
Model Hotel Cover.

Asylum or Gymnasium Covers

These are heavy cast brass guards designed to be placed over the thermostats mounted in locations where they might be damaged, such as gymnasiums, insane asylums, jails, warehouses and factories. They are made in two styles, one permitting the thermometer to be seen and one that covers the entire instrument including the thermometer.

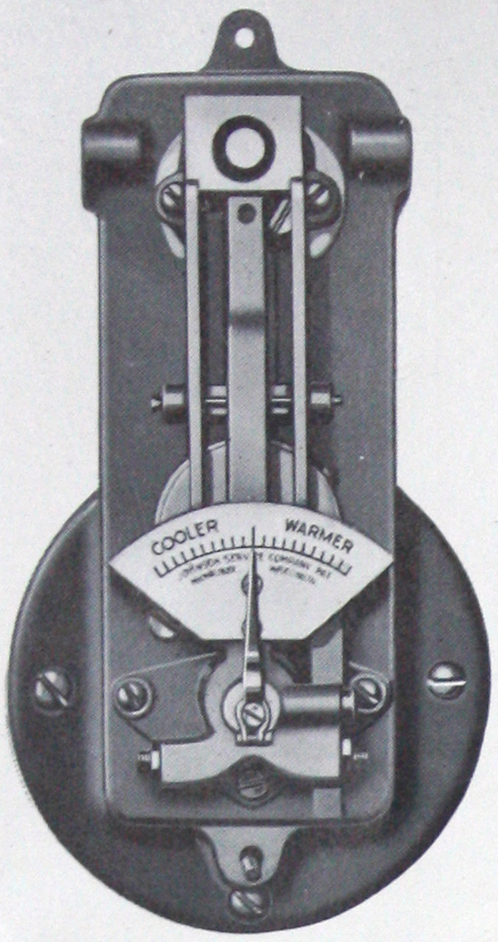


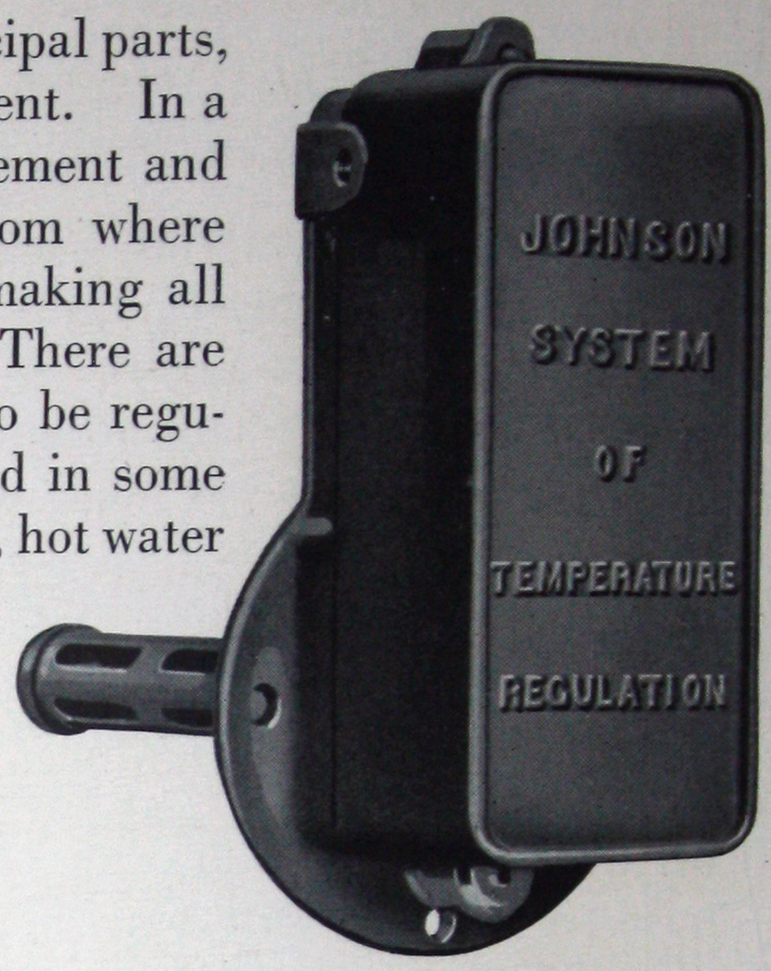
Asylum Cover.



Gymnasium Cover.

Johnson Insertion Thermostat





A thermostat consists of two principal parts, the mechanism, and the sensitive element. In a room thermostat both the sensitive element and the mechanism are located in the room where the temperature is to be controlled, making all parts of the thermostat accessible. There are many places where temperatures are to be regulated that are not easily accessible, and in some cases not accessible at all; for instance, hot water tanks, or any other receptacles containing liquids, hot air ducts, baking ovens for enamels and Japans, sterilizers and pasteurizers; in fact, such places and mediums are innumerable. For these places the so-called insertion thermostat has been invented, designed and manufactured. It is so arranged that the sensitive element is exposed in the receptacle to the temperature of the medium that is to be controlled, and the mechanism is located outside in an accessible place permitting adjustments to be made with ease for the purpose of changing temperatures, and allowing the operation of the thermostat to be observed at will. There is of necessity a great variety of these instruments for different purposes. We manufacture and install thermostats that control liquids as well as gases; some are inserted through thick walls and some through thin walls; all varieties and all kinds are made by the Johnson Company, and all are made for positive action or graduated action as conditions require.

Johnson Unit Thermostat

The thermostat illustrated on this page is called our unit thermostat. It is what is known as a single point thermostat, which is one that operates only one control relay, and if connected to more than one valve or more than one damper, it operates them all simultaneously. This term is used to differentiate from what we call our multiple thermostat, which operates valves or dampers successively at different temperatures and which will be illustrated and explained in the following pages. The unit thermostat is used for controlling water, air, liquids or gases. The thermostatic tube extends through the wall into the space in which a constant temperature is to be maintained. The expanding and contracting member readily assumes the temperature of the surrounding medium, making it sensitive to rapid changes of temperature. The body of the thermostat consists of a dust-proof case containing the two working parts; these are always mounted on the outside of the chamber. The working parts are readily accessible for adjustment or observation in their action. These instruments are excellently constructed and designed on scientific principles to meet very exacting service. The multiplying lever being supported on cone bearings, eliminates the back-lash between it and the expanding member, a common fault with improperly constructed thermostats of this type.

These thermostats, like the others, are made entirely of metal, containing no rubber nor leather diaphragms nor any other organic matter that will deteriorate or become useless with age.

Johnson Multiple Insertion Thermostat and Its Unique Fuel Saving Advantages

Four Point Multiple Thermostat.

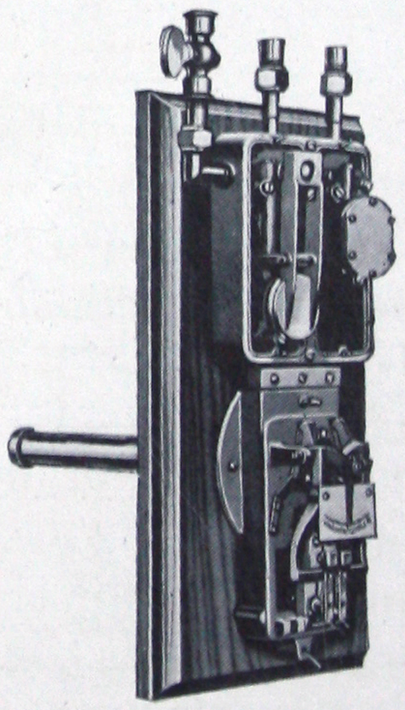
The multiple insertion thermostat is illustrated here. This is a wonderful instrument; with one sensitive element it operates several valves or dampers or combinations of valves and dampers one after the other at different temperatures. The points at which different valves or dampers will be opened and closed may be varied as desired. Banks of heating coils are necessarily of sufficient capacity to heat air from 20 degrees below zero to 150 degrees above zero or sometimes higher. It is obvious that the use of the entire bank of coils at points between these two temperatures would be a waste of fuel. If it were desired to maintain the air temperature at 120 degrees, the entire bank might be needed when the weather was ten degrees below zero, but should the temperature outside be 25 degrees above zero, possibly only three-fourths of the bank coils would be needed, and at 40 degrees above zero possibly only 50% of the coils would be required, while at 60 degrees above zero only a quarter of the coils need to be used. If the multiple thermostat is located inside the air chamber or in the building and it is desired to maintain an air temperature of seventy degrees, the thermostat may be so adjusted that when the temperature reaches 62 degrees, one-fourth of the coils will be cut off; at 64 degrees another quarter, at 66 degrees another quarter, and at 70 degrees the entire coil will be cut off. There will always be a constant relation between these adjustments, inasmuch as all of the operated points are actuated by one thermostatic tube. It would be much more difficult to maintain this constant relation of adjustment should a number of thermostats be used in place of the multiple insertion thermostat.

Multiple thermostats are made in three classes, as follows:

A. POSITIVE-ACTING, MULTIPLE INSERTION THERMOSTAT —having all points positive-acting. — 2-point, 3-point, 4-point

B. GRADUATED-ACTING, MULTIPLE INSERTION THERMOSTAT —having all points graduated-acting. — 2-point, 3-point, 4-point

C. COMPOUND-ACTING, MULTIPLE INSERTION THERMOSTAT —having one point graduated-acting for control of by-pass dampers, and balance positive-acting for control of coil valves. — 2-point, 3-point, 4-point



Two Point Compound

This thermostat does not depend on different tension springs in the valves to be operated, or a combination of reducing valves and springs of different strength to produce the successive operation, but operates the valves one after the other by the increased expansion or contraction of one thermostatic element. Springs of different tension and reducing valves operating at different pressures are only a make-shift and an unreliable and complicated method of producing the results obtained by the Johnson multiple thermostat.

Hot Water Thermostat

This is an insertion thermostat and the name would indicate that it was made for controlling the temperature of hot water only, but it may be and is used for controlling liquids of all kinds, hot or cold, and might more properly be known as "Liquid Insertion Thermostat". Among some of its principal uses are hot water tank control, hot water heating system control, ice water control, brine tank and refrigerator control, air washer humidity control, and it finds many different uses in special manufacturing processes.

Tank Control

Hot water is usually produced by heating water in tanks by means of steam, although it is sometimes done by coal, gas or oil. The thermostat is inserted in the tank and controls a diaphragm valve on the steam supply when steam is the heating medium. When coal is used, the thermostat controls the drafts on the heater by means of a Johnson Sylphon Damper Motor. A great saving is made in the cost of plumbing and repairs by preventing water from getting too hot and destroying the gaskets in valves, causing leaking and general deterioration of the system, and by preventing the waste of fuel caused by overheating.

Hot Water Heating Control

A great many people, including some consulting engineers and architects, are under the impression that hot water heating systems cannot be automatically controlled or that automatic control is unnecessary; this is incorrect. Not only can hot water heating systems be perfectly controlled, but for the most efficient and economical operation they should be controlled. Bodies of hot water heat slowly, and it is only by controlling the temperature of the water and maintaining its temperature within certain limits, that great fluctuations are not experienced in the temperature of the room heated. The Johnson Hot Water Thermostat is admirably suited for controlling the temperature of water in hot water heating systems. The thermostat is inserted in the flow-pipe of the boiler and may be set at any degree desired according to the weather. It maintains this temperature by operating the drafts on the boiler or valves on the gas or oil supply. It prevents unnecessary heating of the water which makes the greatest economy in the use of fuel. The use of a hot water thermostat in connection with the hot water system of heating in a building which is automatically controlled makes it possible to heat the house with the lowest possible degree of temperature of the heating medium required by the outdoor temperature, which is very desirable from a comfort, economic and hygienic standpoint.

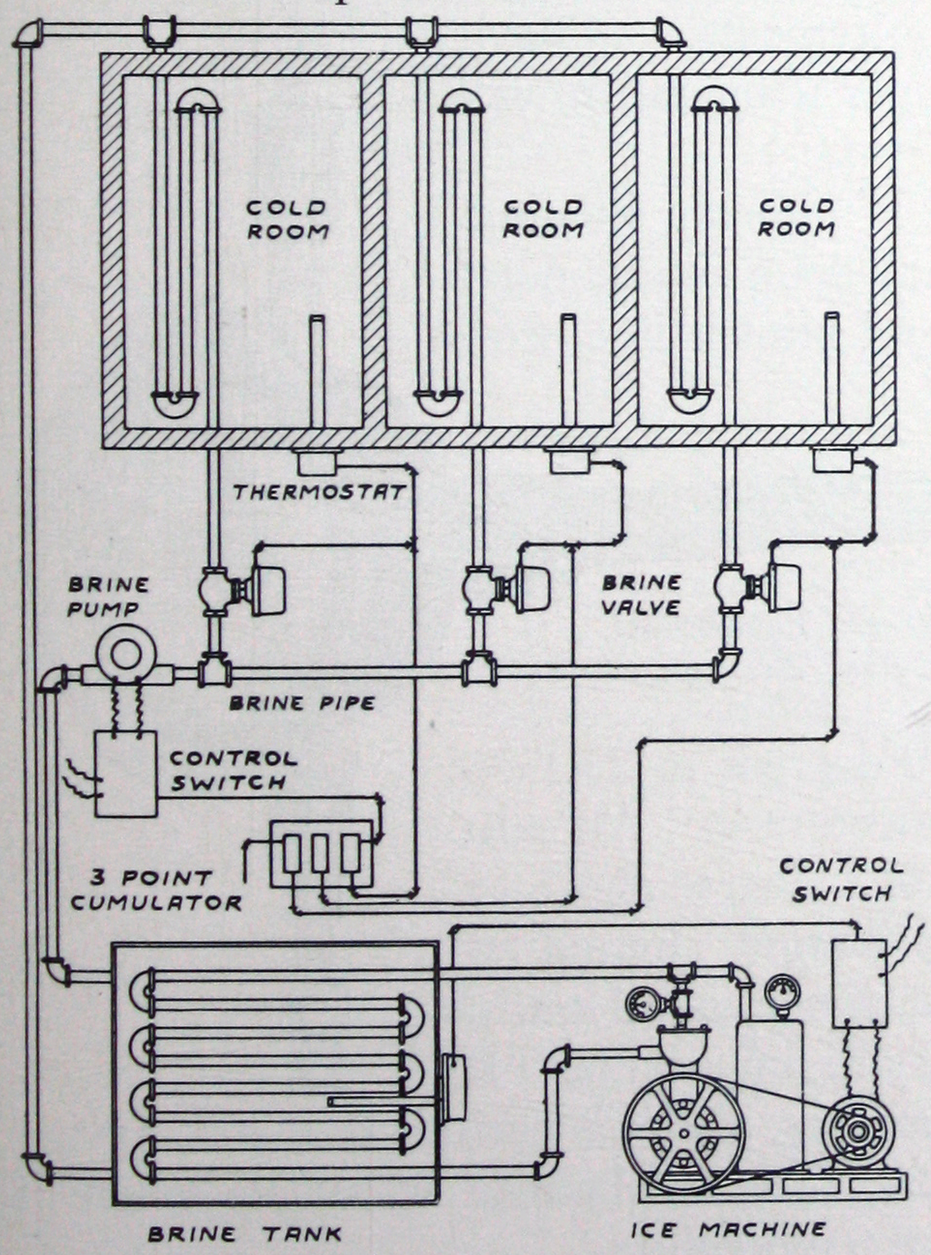
In residences heated by indirect hot water stacks, and especially in connection with the installations where individual fresh air inlets are provided for each stack, it is imperative that some safety device be installed to prevent freezing of the stacks, should the temperature of the water drop too low. The hot water thermostat answers the purpose admirably; it is placed in the flow-pipe and controls the pneumatic dampers located in the fresh air inlets. Should the fire in the boiler go out for any reason, or the temperature of the water drop below the danger point, the thermostat will close the fresh air dampers and prevent the stacks from freezing.

Ice Water Control

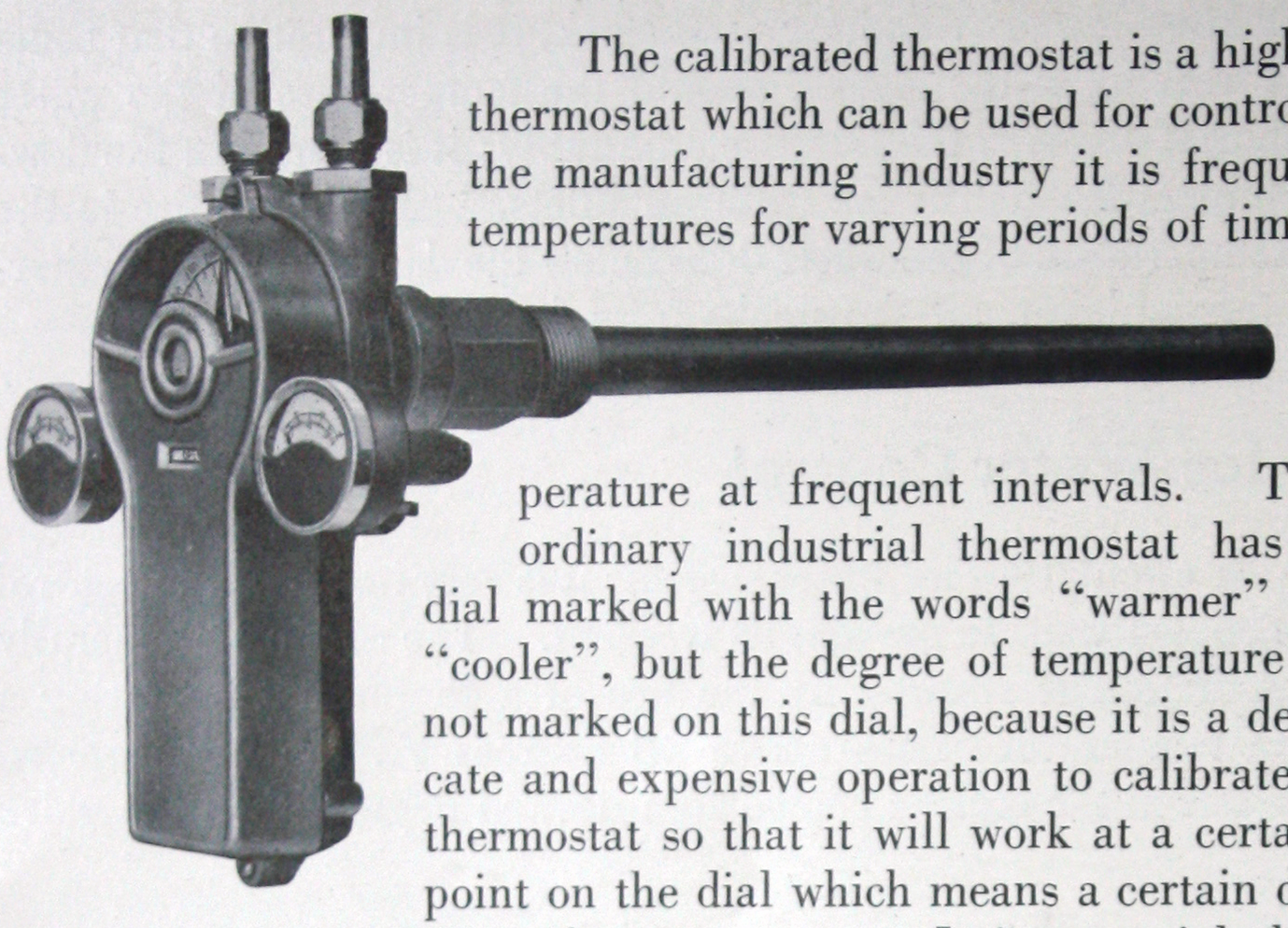
In large buildings provided with circulating ice water systems it is very important to control the temperature of the water in the cooled tank to prevent its freezing. The cooling is generally accomplished with brine coils. Regulation is secured by the use of a thermostat operating a diaphragm brine valve. When the temperature rises above 38 degrees F., the valve opens, allowing the brine to circulate, the water in the tank is cooled to a desired degree, then the valve closes, etc.

Brine Tank and Refrigerator Control

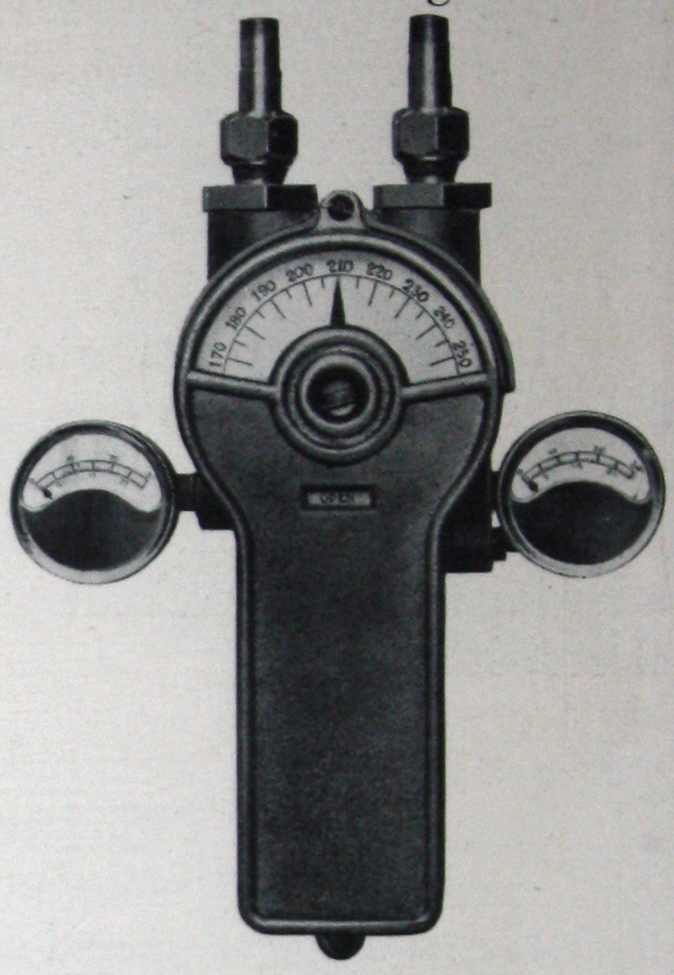
For cooling rooms and refrigerators, the thermostat may be located in the brine tank or inserted through the walls into the cooling space. When it is inserted in the brine tank it operates to start and stop the ice machine according to the temperature of the brine and in that manner it will, of course, control the temperature of the brine and will in a measure control the temperature of the cooling rooms. When it is inserted through the walls into the cooling space, the thermostat may also control the ice machine, or if the brine coils are used for cooling it will operate the diaphragm brine valve so as to give the correct temperature in the room. The better way to control is shown by the illustration where complete control of several rooms cooled by brine coils is effected. Thermostats in each room operate brine valves; an accumulator in turn stops brine circulating pump and a thermostat on the brine cooling tank controls the ice machine. When all the rooms are cold enough, the brine valves close, and while the brine is not being used, its temperature drops rapidly, causing the brine thermostat to shut down the machine automatically. We control ammonia where that is the cooling medium by our special ammonia valve, which holds tight under 200 pounds per square inch pressure.



Calibrated Thermostat

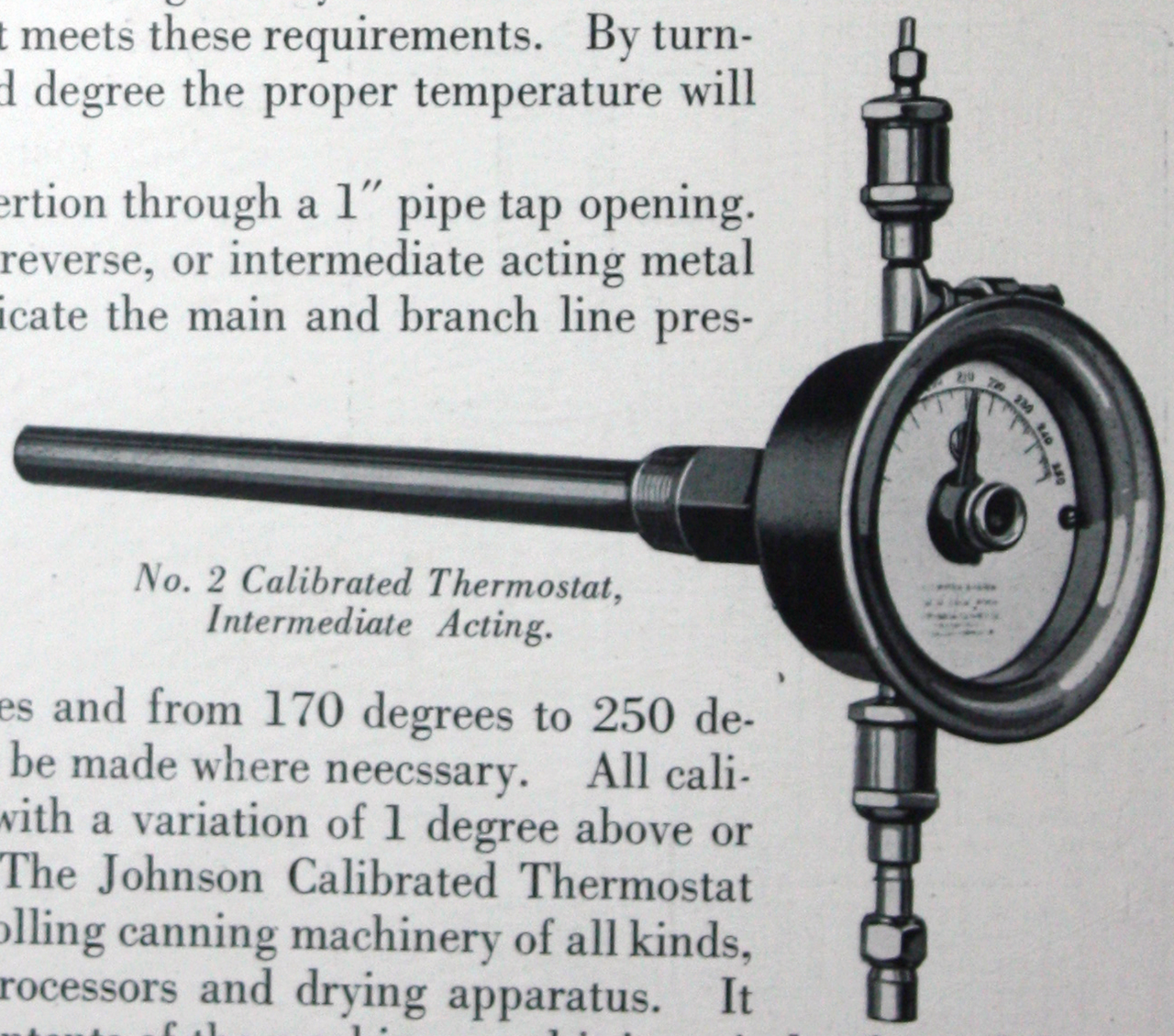


The calibrated thermostat is a highly developed one point insertion thermostat which can be used for controlling either gases or liquids. In the manufacturing industry it is frequently necessary to maintain exact temperatures for varying periods of time and to make the changes in temperature at frequent intervals. The ordinary industrial thermostat has a dial marked with the words "warmer" or "cooler", but the degree of temperature is not marked on this dial, because it is a delicate and expensive operation to calibrate a thermostat so that it will work at a certain point on the dial which means a certain degree of temperature. It is essential that this is done very accurately. In the canning industry it is desired to cook fruit at a temperature of 120 degrees for a certain number of hours and to cook vegetables at 140 degrees for a certain number of hours. It is consequently necessary to have a thermostat that an ordinary operator of a machine can change easily to these temperatures. A calibrated thermostat meets these requirements. By turning the pointer on the dial to the desired degree the proper temperature will be produced.



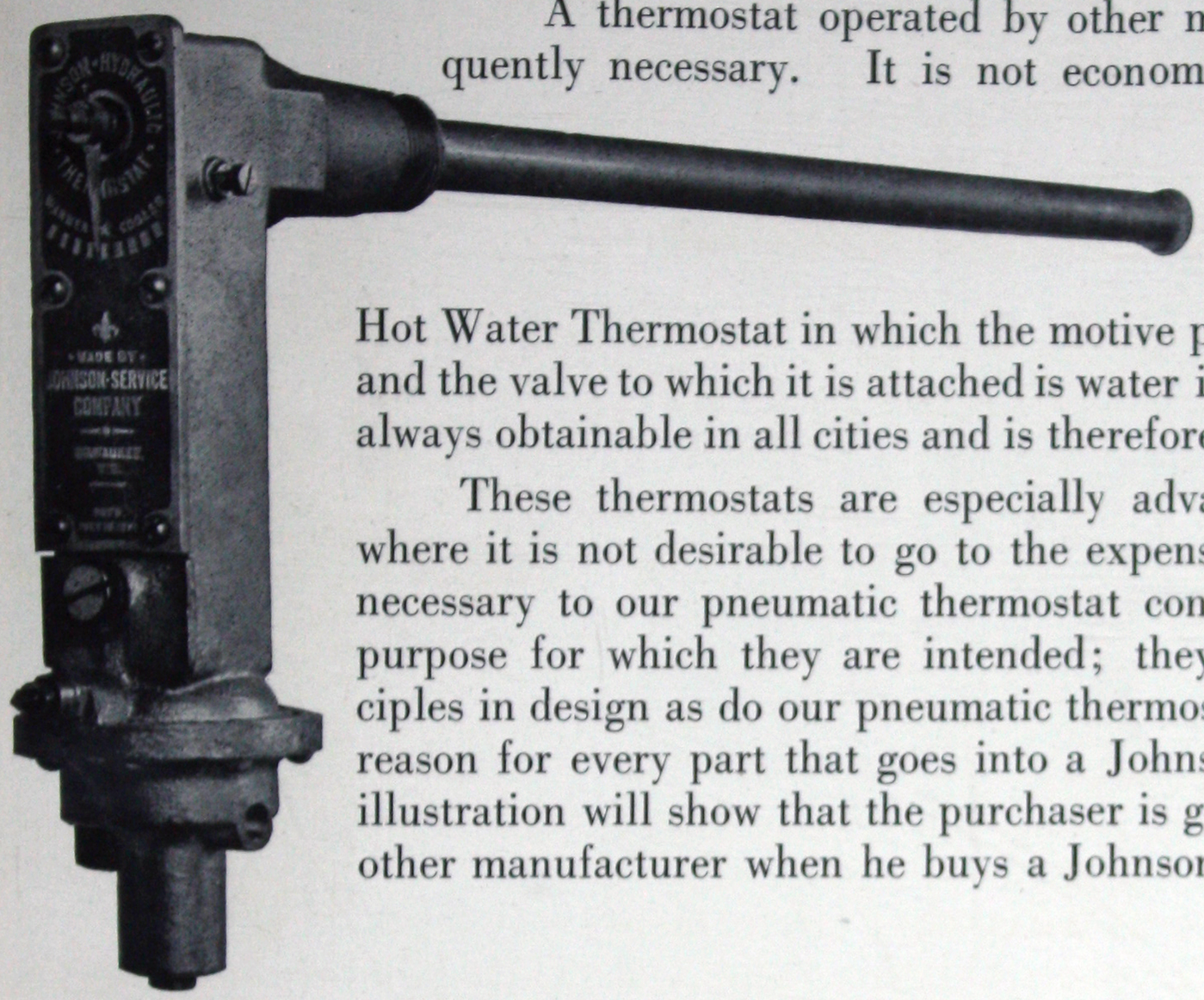
Unit Calibrated Thermostat, Positive Acting.

This thermostat is designed for insertion through a 1″ pipe tap opening. It can be equipped with the positive, reverse, or intermediate acting metal diaphragm relay. Two air gauges indicate the main and branch line pressures and an indicator on the relay shows the position of the valve or damper controlled. The porcelain finished dial is calibrated for a range of 80 degrees. Standard dials are graduated from 40 degrees to 120 degrees, from 120 degrees to 200 degrees and from 170 degrees to 250 degrees. Special calibration of dials can be made where neecssary. All calibrated thermostats operate accurately with a variation of 1 degree above or below the point at which they are set. The Johnson Calibrated Thermostat was especially designed for use in controlling canning machinery of all kinds, such as cookers, exhausters, scalders, processors and drying apparatus. It does not in any way interfere with the contents of the machines, and it is entirely of metal, having no rubber diaphragms to vulcanize and no wearing parts. The mechanism is outside where it can be easily seen and adjusted when necessary to change temperature.



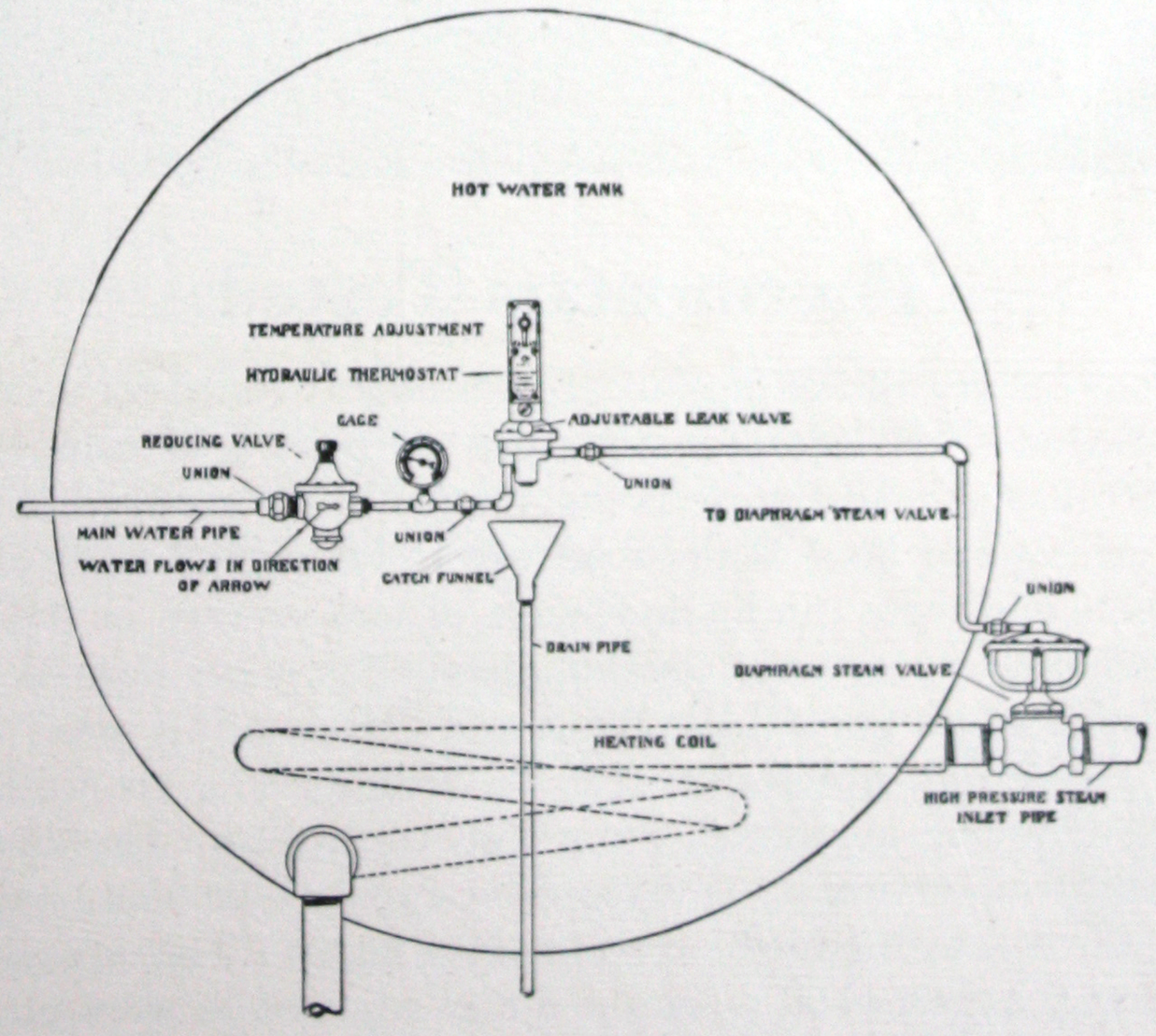
No. 2 Calibrated Thermostat, Intermediate Acting.

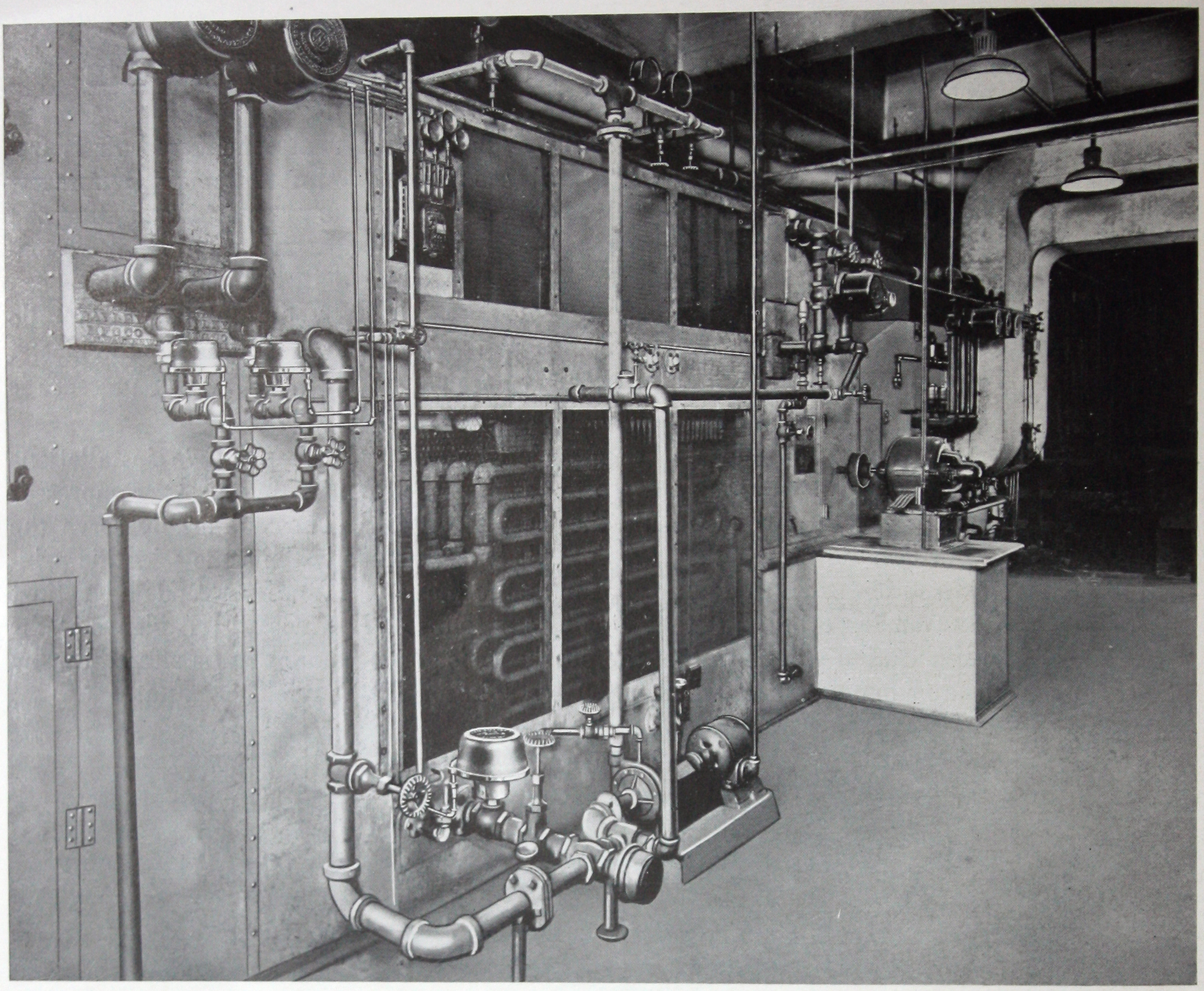
Johnson Hydraulic Thermostat and Its Benefits



A thermostat operated by other means than compressed air is frequently necessary. It is not economical to install an air compressor for the purpose of operating one thermostat; we do not recommend it. This need has been met by the Johnson Hydraulic Hot Water Thermostat in which the motive power for operating the thermostat and the valve to which it is attached is water instead of air. Water pressure is always obtainable in all cities and is therefore a reliable medium.

These thermostats are especially advantageous on single installations where it is not desirable to go to the expense of installing an air compressor necessary to our pneumatic thermostat control. They admirably serve the purpose for which they are intended; they embody the same scientific principles in design as do our pneumatic thermostats. There is a good and distinct reason for every part that goes into a Johnson Thermostat. A glance at the illustration will show that the purchaser is getting more than is offered by any other manufacturer when he buys a Johnson Hydraulic Thermostat.





Thermostats Tested

Before leaving our factory all thermostats are thoroughly tested for accuracy, efficiency, and permanency of adjustment. The equipment for this purpose is as complete and elaborate as man can make it. A constant temperature is maintained in the room where the thermostats are tested. The walls, ceiling and floor of the room are 12″ thick and made of insulating material. The windows are double and there can be no change of temperature in the room except by the heating apparatus, and this apparatus is capable of producing any desired temperature for any length of time. It consists of a steam blast plant and refrigerating plant of the most modern type, equipped with tempering, pre-heating and re-heating coils, air washer and conditioner, humidifying and dehumidifying apparatus, completely controlled. The thermostats are put into the room and a constant temperature is maintained for twenty-four hours and is then changed to another temperature which is maintained for twenty-four hours. This process goes on for a week, at the end of which time the thermostat is seasoned and adjusted to work at any temperature for which it is designed; or if not up to our exacting requirements it is cast aside.

Thermometers

Sunrise Thermometer.

For the purpose of gauging the correctness of operation of a thermostat and assisting in the adjustment whenever adjustment is necessary, a thermometer is required. A thermometer is not a part of a thermostat, although modern installations usually require that each thermostat shall be provided with a thermometer.

The thermometer for room thermostats is mounted on the cover of the thermostat, or forms a part of the cover of the instrument. The same temperature which affects the thermostatic strip will affect the mercury column. Thermometers for indicating the temperature of enclosed spaces, such as ducts, tanks and plenum chambers, must be similar in design to thermostats which control temperatures in such places. The mercury column is exposed to the medium, the temperature of which is to be indicated on a scale outside in an accessible place where it can easily be read. These thermometers are generally placed alongside of the inserted thermostat.

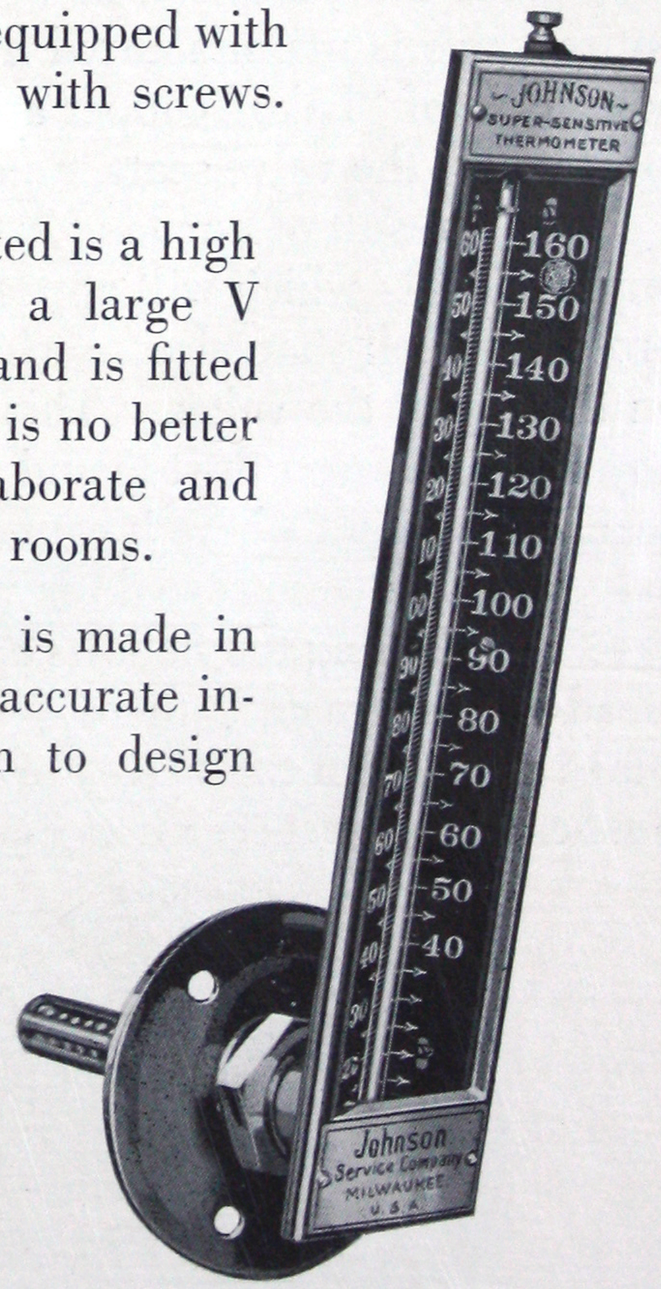
The Johnson Service Company provides with their thermostats any thermometers that are specified. It manufactures in its own plant all forms of thermometers except dial and recording thermometers. We illustrate herein some of the types that are used. The thermometers which are placed on the fronts of our thermostats are mercurial type with Jena glass tubes. The temperature scale is finished in black with white letters, but it can be finished in any manner desired. The Sunrise thermometer herewith illustrated is a high grade instrument for mounting on galvanized iron ducts. The standard tube is 6″ long, and as it is equipped with a flange the thermometer is easily fastened to the wall of the duct with screws. The Sunrise thermometer is made only in the angle pattern.

Hot Water Thermometer.

The Supersensitive thermometer herein illustrated is a high grade instrument for the same purpose. It has a large V shaped scale, tilted slightly, with magnifying tube and is fitted with a screwed flange for mounting. In accuracy it is no better than the Sunrise thermometer, but it is more elaborate and generally more appropriate for very high class engine rooms.

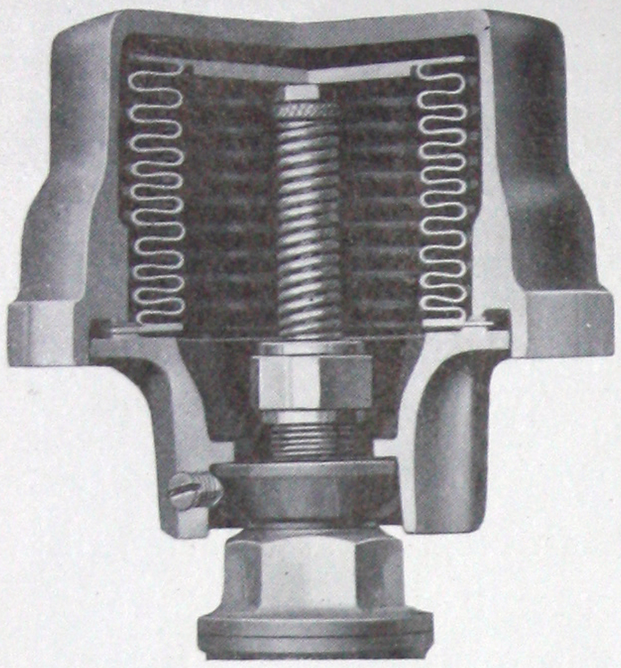
The Hot Water thermometer herein illustrated is made in angle and straight patterns. They are reliable and accurate instruments, made with the same care and attention to design and appearance that characterizes all Johnson apparatus.

The Johnson Service Company is prepared to furnish Dial, Index or Recording Thermometers in standard makes in connection with our contracts for temperature regulation. We can also furnish our special 42-day Johnson Graphic Recording Thermometer for Automatic Temperature Regulation records.



Supersensitive Thermometer.

Johnson Metal Diaphragm Valve



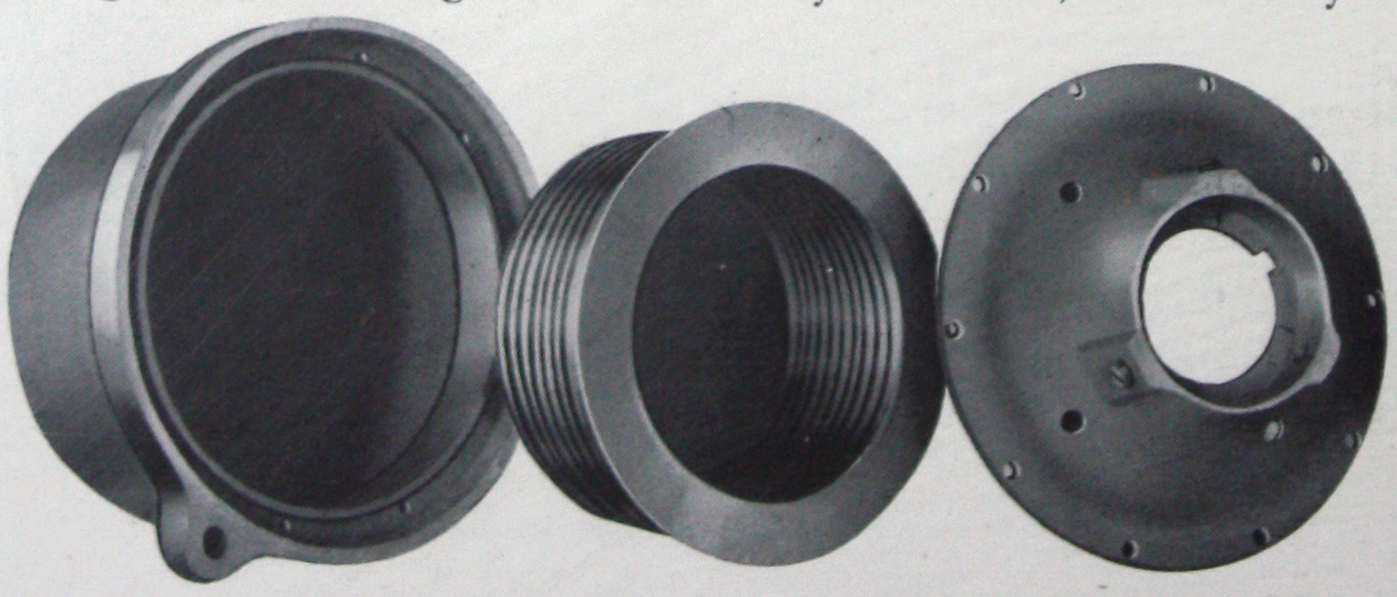
The desirability of using metal diaphragms for operating valves in connection with automatic temperature regulation has been recognized from the inception of pneumatic systems. Time and money have been spent in attempting to find a practical and reliable metal diaphragm, but without success until the invention of the Sylphon and its adaptation to the Johnson valve.

Built-up metal diaphragms are older than temperature regulation and are made by soldering a series of thin corrugated metal discs together in the form of a bellows. This is the first idea which occurs to the man who desires to make a metal diaphragm which will have sufficient motion to operate a steam valve. It is one of the ideas that came to us twenty-five years ago, but lasted only long enough for us to give it a thorough try-out. The metal discs failed under the continuous expansion and contraction to which the bellows was subjected in actual service in the temperature regulating system. The soldered joints cracked and developed leaks under the continuous strain. The Sylphon Bellows has no soldered joints; it is made up of a large number of folds so that as it lengthens and collapses very little motion, or strain, is applied to any individual fold. In the Johnson Sylphon metal diaphragm valve we have produced the perfect valve for temperature regulating purposes. It is the greatest improvement made in automatic temperature regulation in a long period.

With the exception of the Sylphon and the Jenkins discs, which are used exclusively, the entire valve is manufactured in our factory. The bodies are cast in our foundry from the very best grade of "Lake" copper and "Straits" tin. The valve bodies are fine grained and free from blow holes; the valve seats, union seats and threads are machined perfectly and make up tight.

As a result of our long experience in this line of business the valves have several mechanical improvements which will appeal to the engineer. The Sylphon bellows is entirely enclosed in a protecting bell-shaped case which is strongly built to withstand abuse such as kicking or standing on the top of the valve. This top can be turned without altering the lift of the valve or leaving any space between the top and the center piece. The air connection can therefore be made at the rear, out of sight where it cannot be injured, which is extremely important, especially for radiator valves. The compressed air which operates the valve is admitted to the case surrounding the bellows and acts upon the outside of the bellows instead of the inside, thereby making the operation more economical. Since all parts of the valve are enclosed in a simple round case, free from dust-catching corners or angles, it is not only attractive, but sanitary.

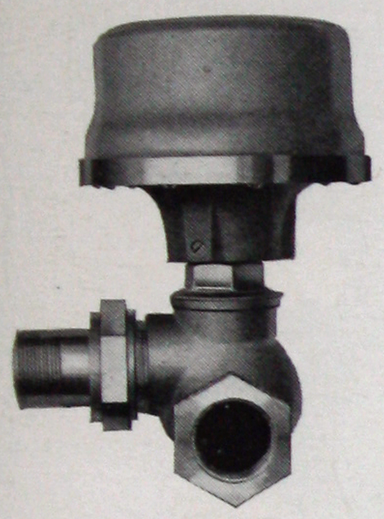
Valve Assembly.



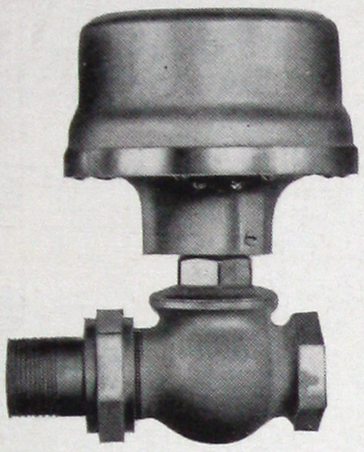
Sylphon Radiator Valves

The Sylphon valves for radiators are made in all standard shapes and sizes, from ½″ to 2″, with or without unions. The bodies are all of very high grade brass, "Lake" copper and "Straits" tin, and are cast in our own foundry. Valves for direct radiators are usually nickel-plated all over, having the union nuts and center pieces polished, and are called nickeled valves. Valves for indirect radiators are usually furnished with black japan tops and are called plain valves.

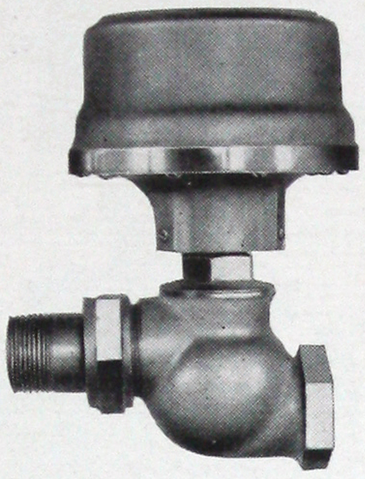
Union Radiator Valves



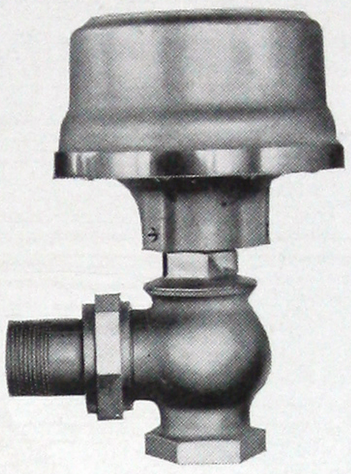
Offset Corner.



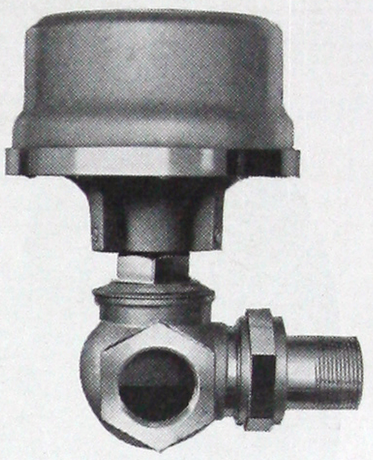
Globe.



Offset Globe.



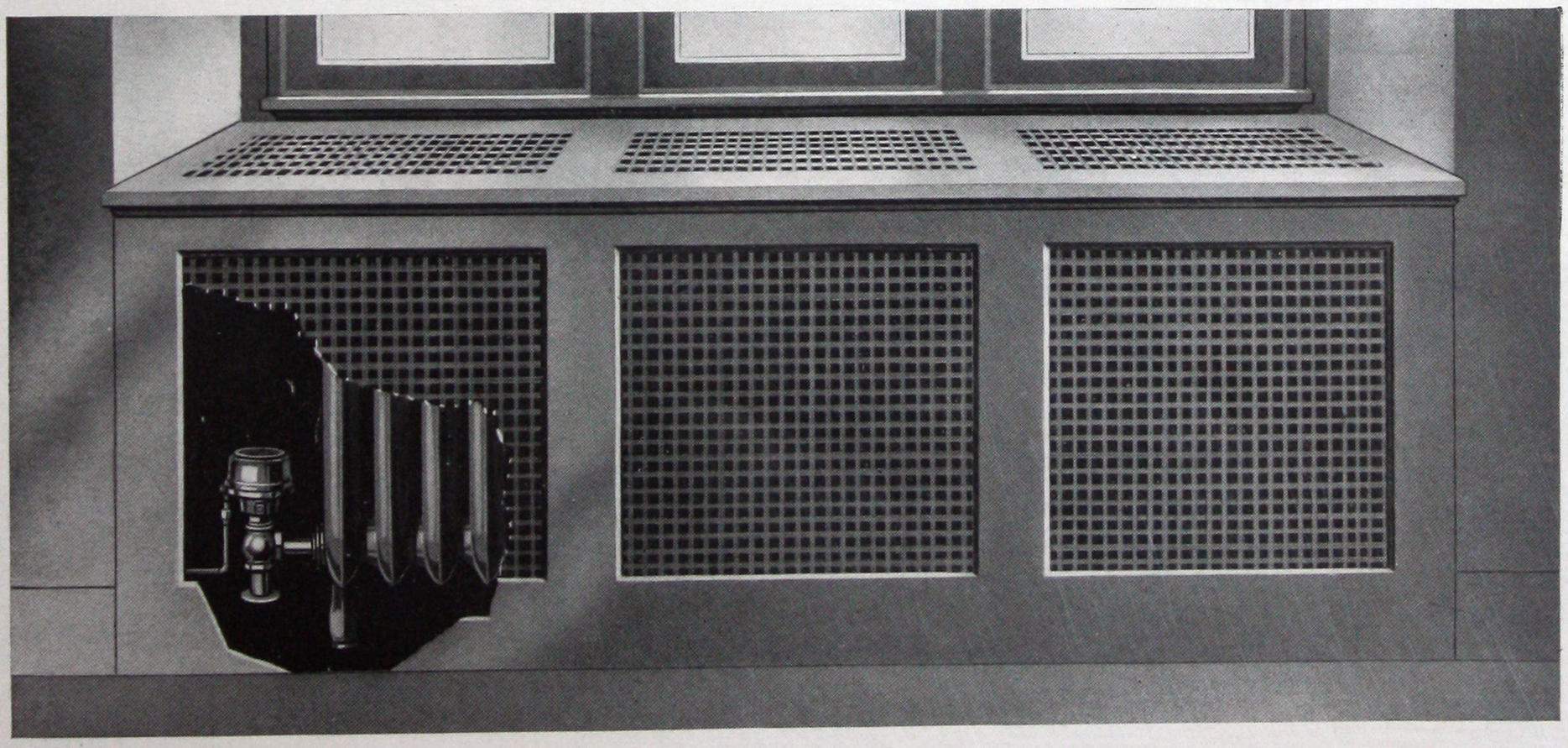
Angle.



Straight Corner.

Window Seat With Radiator Behind Grill

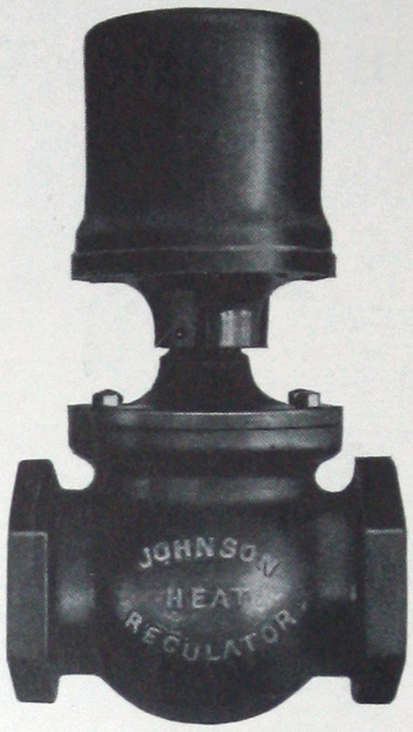
Diaphragm valves on radiators in window seats, or behind grills, or similar enclosed spaces, operate under very severe conditions. The intense heat will very soon vulcanize a rubber diaphragm and it is sometimes quite difficult to remove the grill and change the diaphragm on a valve in so confined a space. The Sylphon valve overcomes all of the objections to placing diaphragm valves on radiators in such spaces, as the Sylphon is permanent and neither heat nor moisture can destroy its efficiency. It will last for many years and there will be no necessity to remove the grill or change the diaphragm.



Coil Valves

These valves are made in any size, from 1½″ up to 6″, in either the angle or globe patterns. Valves up to 2″ have brass bodies and are similar in all respects to our plain radiator valve and are made for any pressure up to 80 pounds per square inch. Valves over 2″ in size are provided with iron bodies, but in other respects are similar to the plain radiator valve, without unions, and are capable of operating against pressures of 50 pounds in the smallest size down to 5 pounds in the largest size.

6″ Flanged Globe Valve.



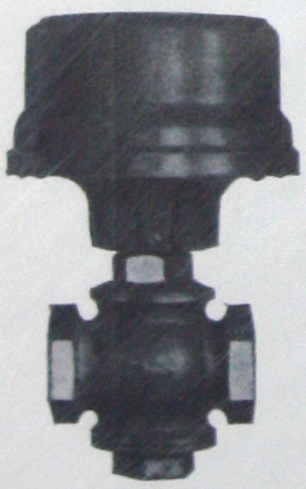
4″ Screwed Globe Valve.

2½″ Screwed Angle Valve.

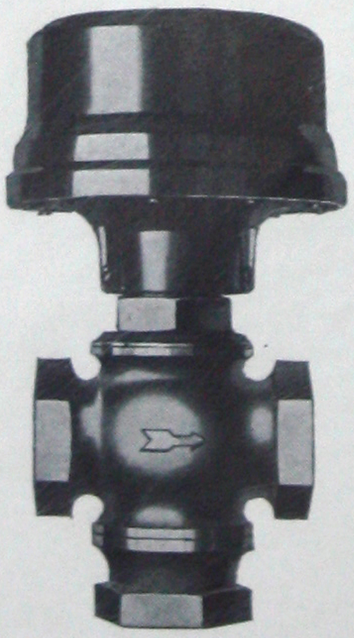
Other Sylphon Valves

In addition to the regular line of radiator and coil valves, we furnish the following special valves with Sylphon tops:

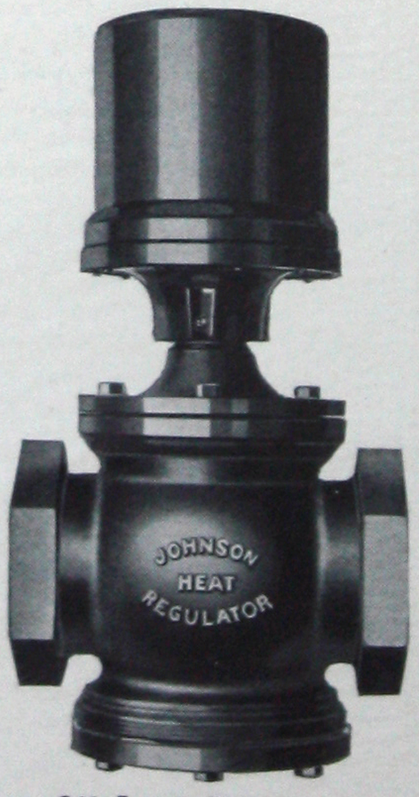
1. Valves for the control of brine and refrigerating plants. 2. Balanced valves for controlling steam and water at high pressures. 3. Reverse acting valves for conditions where it is desirable to have the valve normally closed and opened by the air pressure. 4. Three-way valves for air washer control, admitting a mixture of steam and water, or water at two different temperatures when so desired.



1¼″ Brass Reverse Valve.



2″ Brass Three-Way Valve.



3″ Iron Reverse Valve.

4″ Iron Three-Way Valve.

Seamless Sylphon Metal Bellows

The Sylphon Metal Diaphragm used in the Johnson-"Sylphon" Valve is made from a single sheet of the best quality brass, drawn and formed into a cylindrical bellows which is absolutely seamless. The grain of the brass runs lengthwise of the cylinder and at every point in the circumference it is always parallel to the line of action of the bellows. In other words, the grain of the brass meets the pressure and action of the bellows end on. This is most important to the life of a metal diaphragm having any appreciable amount of movement, as is the case in metal diaphragm valves used for temperature regulation, and has its parallel in a piece of wood which will stand much pressure and bending with the grain, but will snap quickly if the pressure is applied across the grain.

Seamless Sylphon Metal Bellows.

There is nothing simpler than a Sylphon Bellows, now that it has been successfully produced on a commercial basis, yet years of hard thinking and experimenting along scientific lines were required to bring it to its present state of perfection.

No hastily built-up, seamed and soldered bellows is ever going to accomplish the successful results secured by the Sylphon bellows, which is the outgrowth of years of experience and based upon sound principles in its design. The shape of the corrugations, their depth, and the thickness of the metal at the various points of the loop are all important factors. The cylindrical shape of the bellows and the relation of the depth of the corrugations to the diameter of the bellows are not accidents, but the result of experiment and ingenious design. The Sylphon bellows exerts more power, size for size, than any other type of diaphragm, and decidedly more than the built-up disc type of metal bellows.

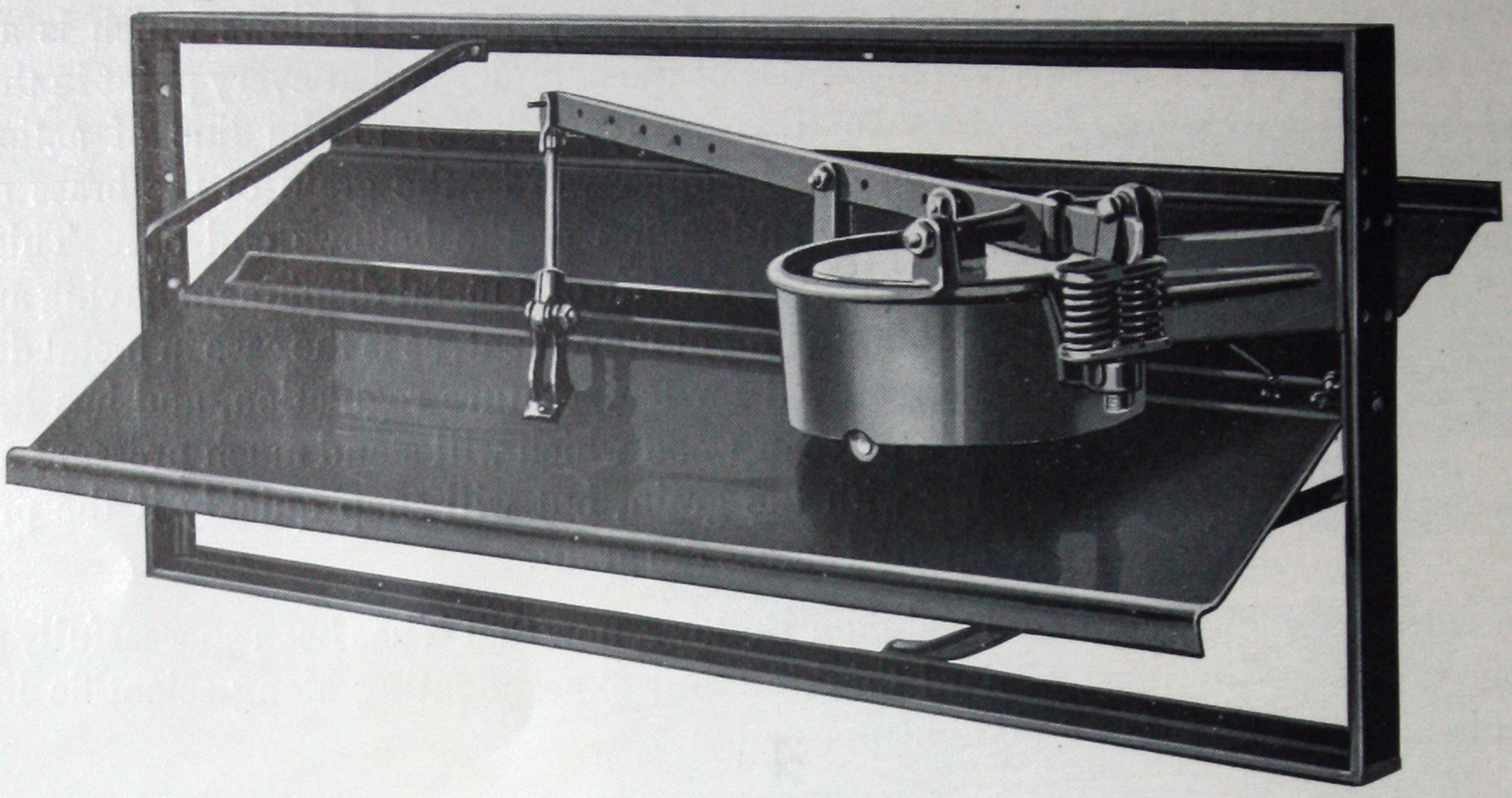
Valves Guaranteed for Ten Years—Last a Lifetime

Sylphon Bellows of every size and style used in our valves and damper closers have been tested to operate over 100,000 times without any apparent effect on the bellows; and except for valves used for industrial processes and under other conditions where the operations may be 100,000 times in one year or even less, the bellows are guaranteed for ten years. We confidently believe they will last a lifetime.

Important Notice

The Sylphon TRADE MARK bellows used in the Johnson valves and damper motors are manufactured by the Fulton Company of Knoxville, Tennessee. We are licensed to used these Sylphon TRADE MARK bellows in connection with our devices, by the Fulton Company, which is the owner of Letters Patent on the seamless bellows as it appears in those devices. Sylphon TRADE MARK is a trade mark belonging to the Fulton Company and represents a distinctive type of metal diaphragm. Infringement of the patents and of the trade mark will be prosecuted by the Fulton Company.

Johnson Dampers



The Single Square or By-Pass Damper.

The Johnson Pneumatically Operated Dampers are made in any size and of every known type, such as single, right angle, end to end, and round and rectangular louvre. They are used for many purposes in connection with modern systems of heating and ventilation, being operated by thermostats, pneumatic switches, night and day clocks, pressure governors, etc., described elsewhere in this book. Many types of dampers now universally used were designed by us; WE WERE THE ORIGINATORS OF PNEUMATICALLY CONTROLLED DAMPERS FOR AUTOMATIC TEMPERATURE REGULATION.

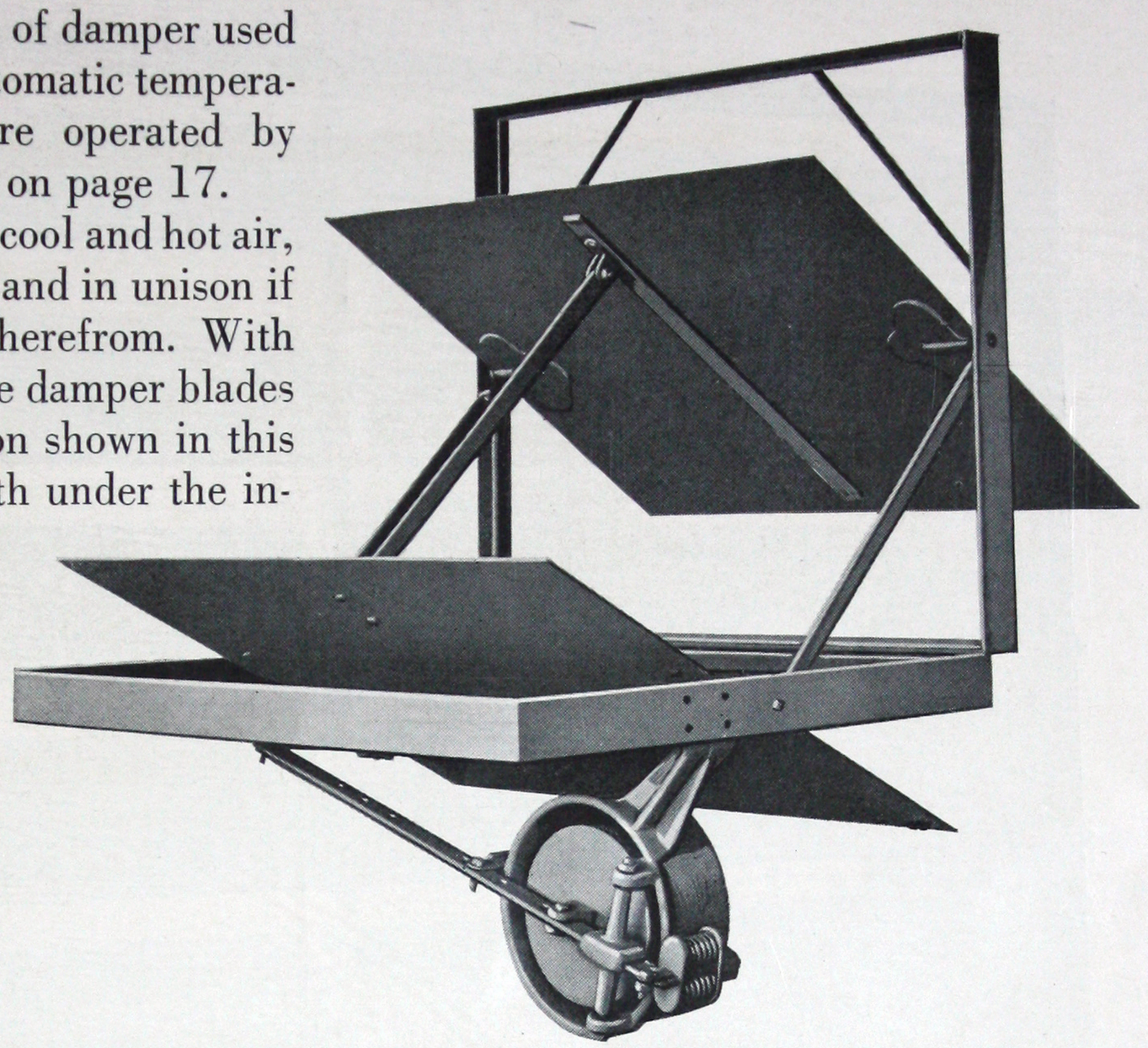
The question of proper dampers for this class of work is most important and is as essential for good temperature regulation as the thermostat. The thermostat dictates the operation of the damper to maintain the proper temperature, but it devolves upon the damper to do the work. A damper which sticks on its bearings will not do the work; neither will one which binds after being set in place, due to the pressure exerted against it by the sagging of the flues or plenum walls into which it is built.

It takes very little pressure on the corner of an improperly braced damper frame to change its shape, but the damper blade does not change, and if it will no longer fit the frame, IT STICKS. A sticking damper is something that engineers and janitors will not adjust; in nine cases out of ten the damper is in an inaccessible place, and it will be neglected and temperature regulation of the particular room controlled by this damper is no longer accomplished. We know these things from many years' experience and have profited thereby to the extent that the Johnson dampers are made with particularly heavy frames to withstand sagging of the ducts. The blades are made of heavy sheet steel and have brass, and in large sizes, roller bearings. The entire damper is treated to two coats of japan enamel, which insures ample protection against rust.

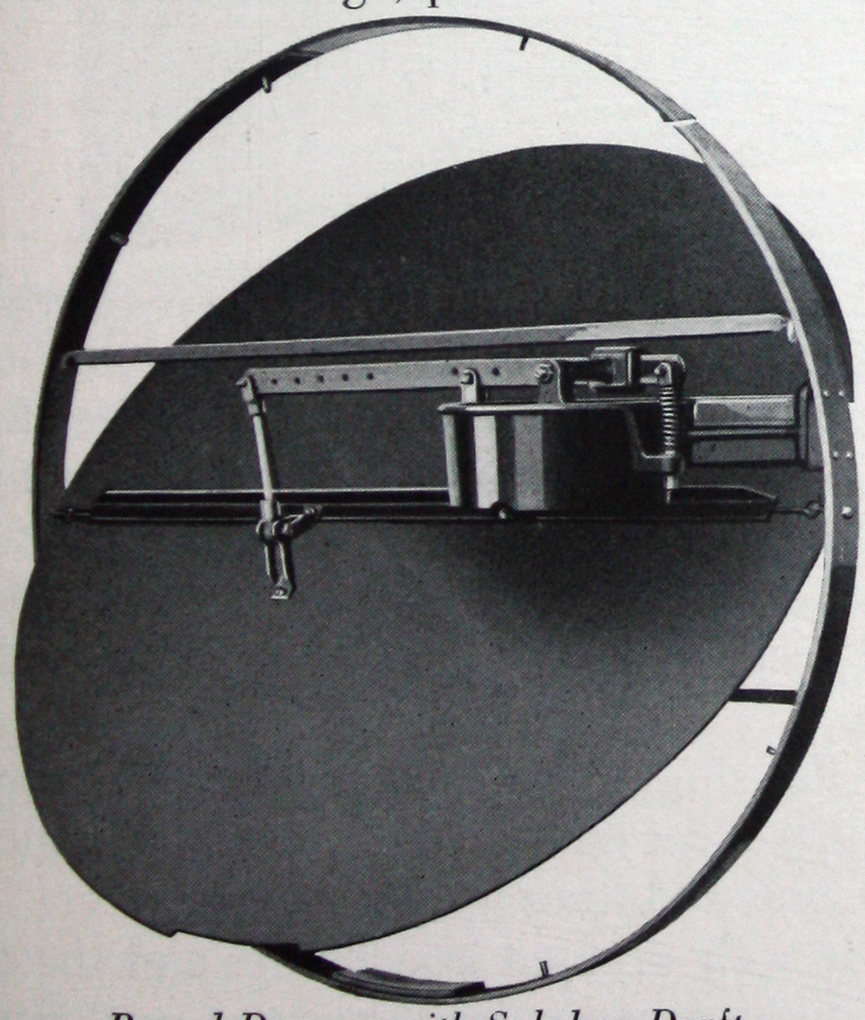
Double Mixing Dampers

This is the most important type of damper used in connection with our system of automatic temperature control. These dampers are operated by intermediate thermostats described on page 17.

The lower and upper blades for cool and hot air, respectively, must work very freely and in unison if graduated action is to be obtained therefrom. With the Johnson Thermostat Control the damper blades will remain for hours in the position shown in this illustration and move back and forth under the influence of the thermostat just a sufficient amount to mix the hot and cool air to the right degree. Besides the regulation of the temperature of rooms by the mixing of hot and tempered air supplied thereto, this damper has the advantage that it interferes in no way with the volume of air delivered. No matter in what position the damper blades stand, the volume of air passing through the damper remains the same. Johnson mixing dampers are designed and built to meet the requirements of fan blast systems of heating where the velocity of air passing through the damper is considerable. Large, powerful and well braced pneumatic diaphragm attachments are required for operating the damper blades with graduated action, and also to prevent them from flapping.



Double Mixing Damper with Sylphon Draft Regulator Attachment.

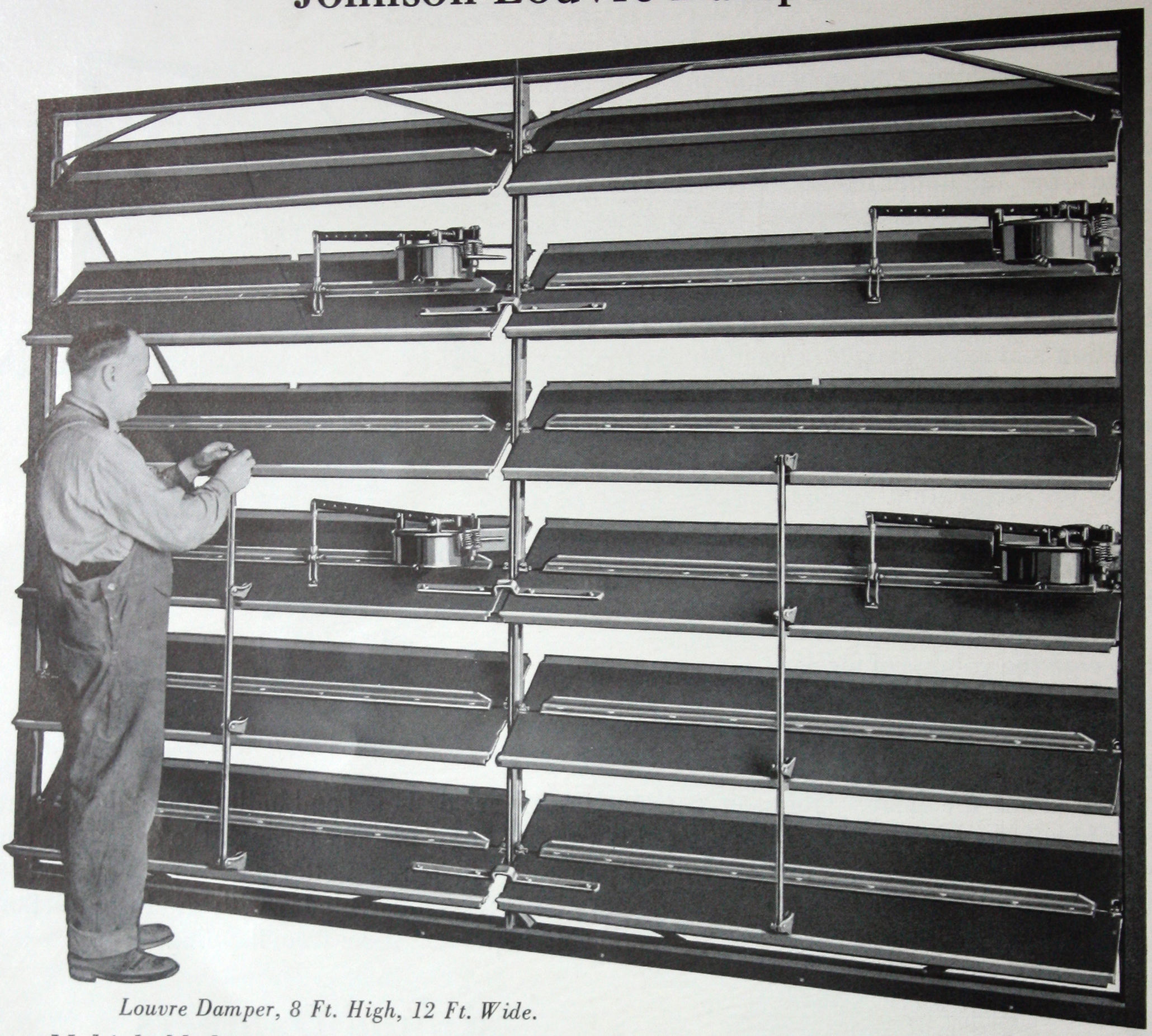


Round Damper with Sylphon Draft Regulator Attachment.

Round Dampers

Round dampers are used mostly in roof ventilators, but sometimes are required for round ducts. They are made in all sizes, and when over six feet in diameter the blades should either be very strongly braced or made with louvres. The special machinery which we have for making rigid and perfect round blades makes possible the best and most durable damper of this shape. These dampers, like other dampers of Johnson make, have brass bearings, and are operated either by attachments secured to the frame of the damper, or secured to some nearby support, and are given two coats of black japan to prevent rusting.

Johnson Louvre Dampers



Louvre Damper, 8 Ft. High, 12 Ft. Wide.

Multiple blade, or as they are customarily called, Louvre Dampers, are frequently used and are positively necessary for large ducts where, on account of the volume and pressure of air in the duct, it would not be practical to operate a single-bladed damper. They are made also in sizes to meet conditions arising from limited space or an obstruction where it would not be possible to swing a single blade.

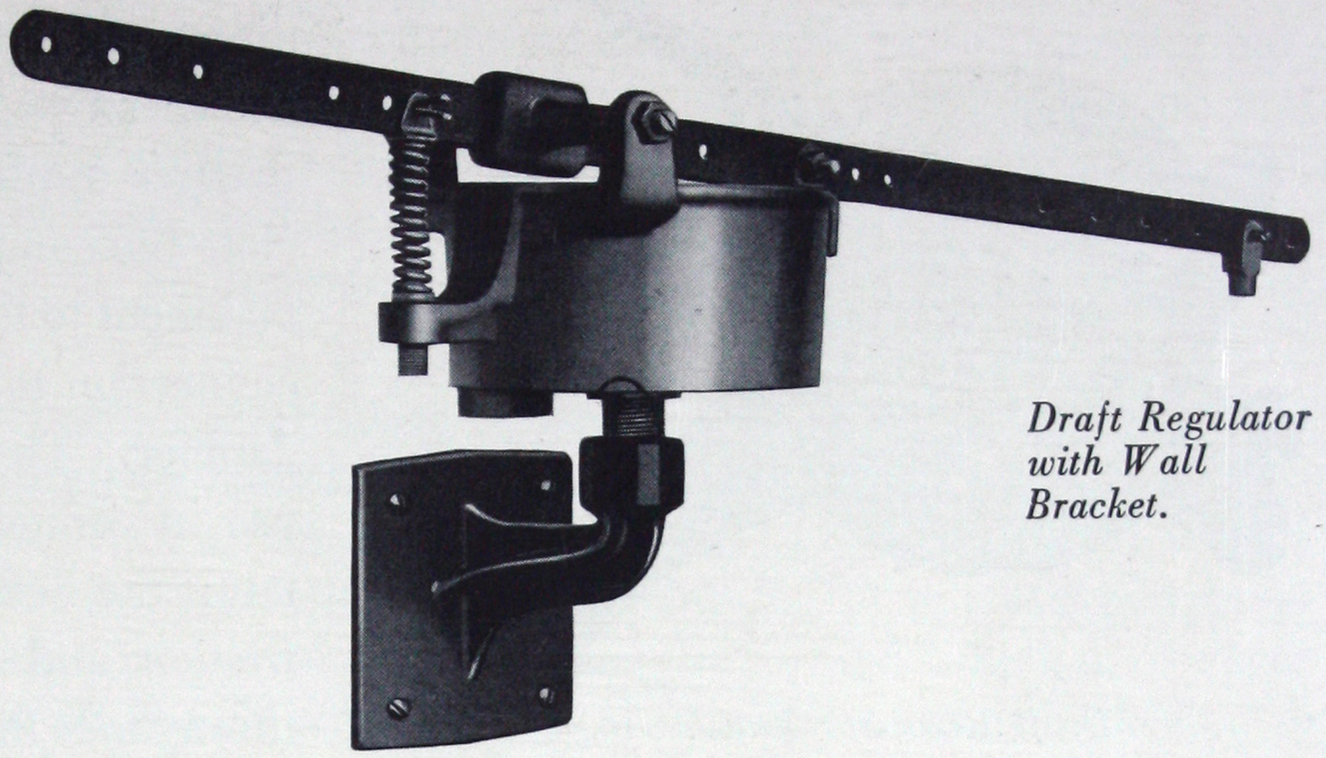
These dampers are carefully and strongly made to insure the frictionless movement of the blade and the absence of any distortion. The edges of each blade are perfectly straight and slightly overlap the other blade to prevent leakage.

The Johnson louvre dampers, as in fact do also all of the single blade dampers of any size manufactured by the Johnson Company, have a lip on the edge of the blade which interlocks in the next blade, and not only prevents any leakage of air, but stiffens and trues up the damper.

These dampers, like all of Johnson dampers, are made with wrought iron frames and sheet steel blades, and the entire damper is given two coats of black japan paint to prevent rust, but they can be made when desired with galvanized iron blades, or copper blades at a slight additional expense.

Johnson Damper Motors

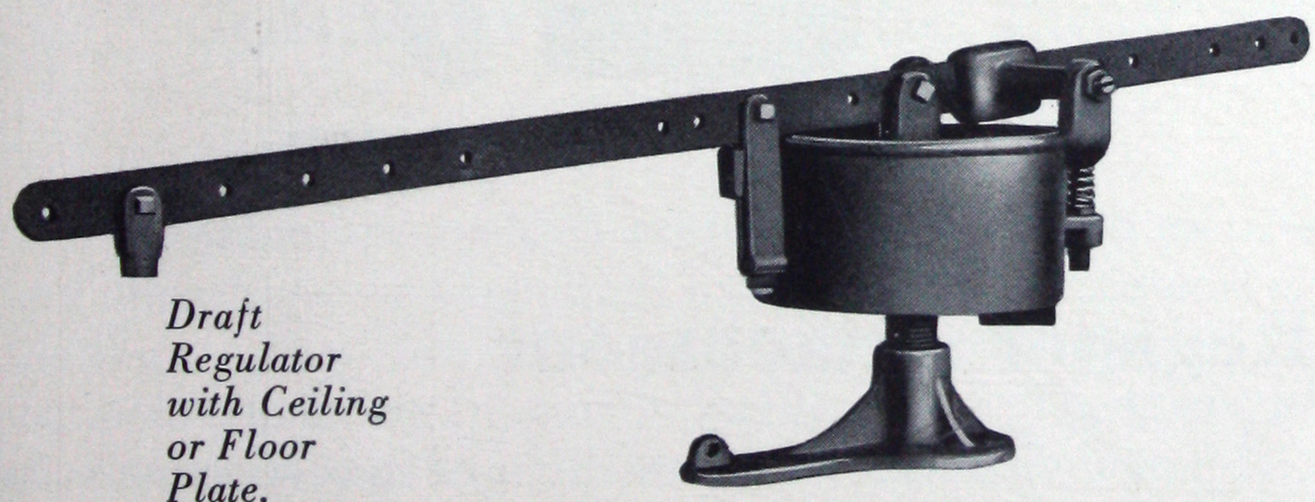
"Damper motors" is the general term covering the devices which directly operate the dampers in an installation of automatic temperature regulation. These motors consist simply of a diaphragm which operates a lever attached to the damper. Some of these damper motors are attached to the damper frame and some are made to fasten on the wall, ceiling, or other support.



Draft Regulator with Wall Bracket.

To meet all conditions of location and to operate all forms of dampers, the Johnson Company manufactures a line of these devices, each with its distinguishing name such as Draft Regulator, Damper Attachment, etc., in which the bearings are made of brass and the springs adjustable. The entire damper motor is baked japan so as to be rust proof. The diaphragm is the celebrated patented Sylphon Bellows and as the Sylphon is not affected by heat or moisture, the damper motor may be placed in hot, as well as tempered air flues.

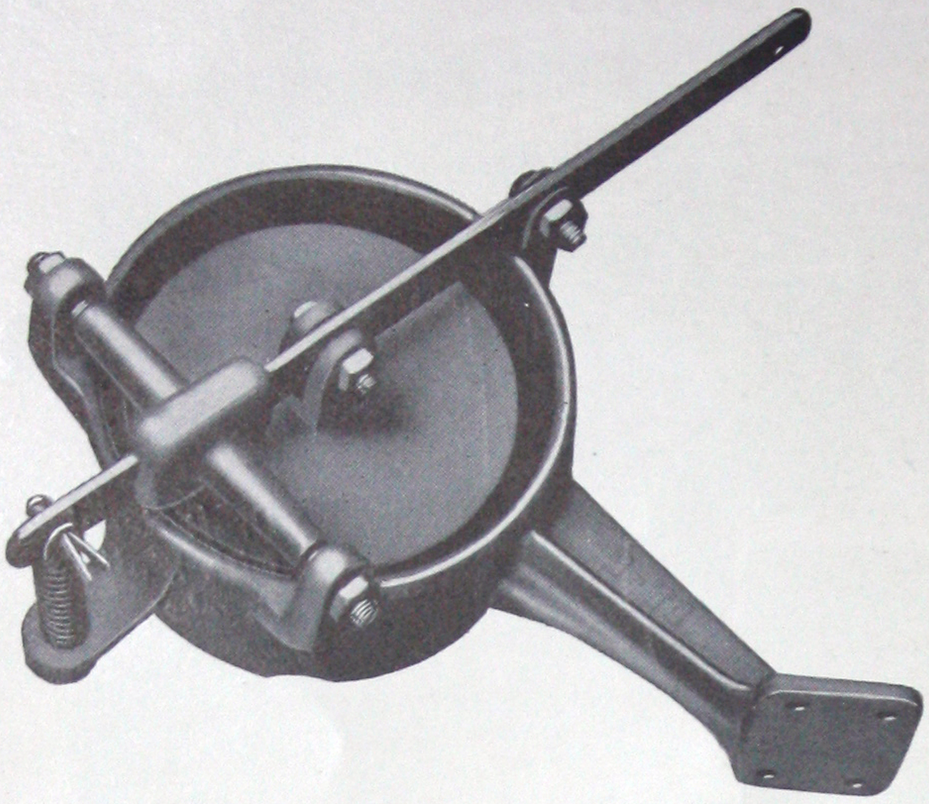
Sylphon Draft Regulator



Draft Regulator with Ceiling or Floor Plate.

Where it is impractical or undesirable to attach the motor to the frame of the damper, the draft regulator here illustrated is used, as it can be attached to either wall, ceiling or floor. The upper illustration shows the motor with a bracket for walls and the lower illustration with a plate for fastening to ceilings or floors. It is used with either single, double or multi-blade dampers and is of the same general construction as the draft regulator attachment and its diaphragm is the celebrated Sylphon seamless metal bellows.

Sylphon Draft Regulator Attachment

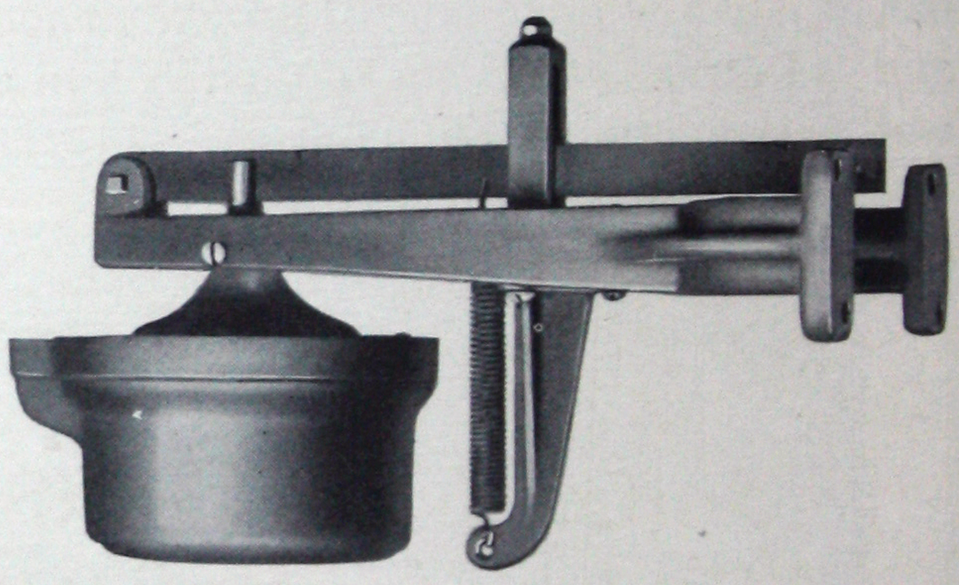


Draft Regulator Attachment.

Nothing could be more simple in design, more direct and positive in action than this motor. It is shown on page 35 in connection with the mixing damper applied to a hot blast system of heating. Note the compact arrangement for fastening the attachment to the damper frame and the direct simple connection to the tempered air blade of the mixing damper. The attachment is excellently adapted for use in connection with graduated-acting thermostats; the bellows is perfectly free from any initial friction and the pressure area remains constant throughout the stroke. We favor this style.

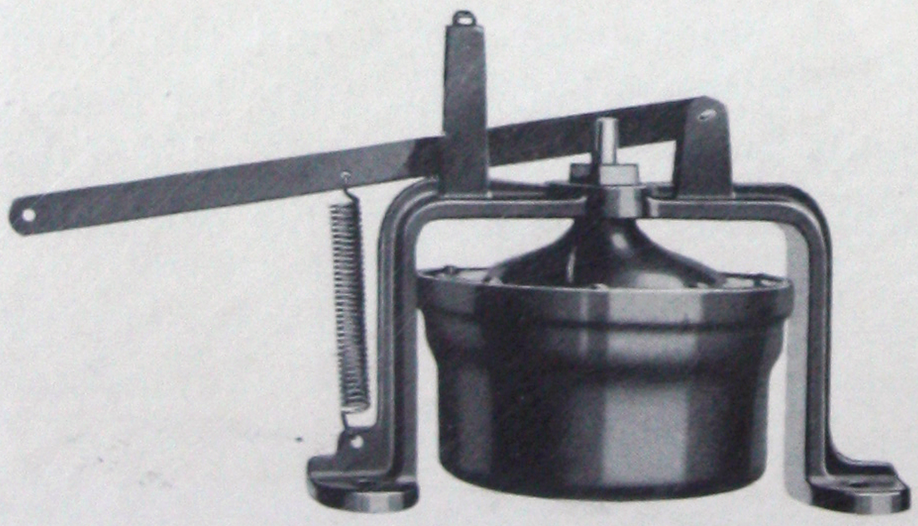
Sylphon Diaphragm Attachment

This is another form of motor to attach to the frame of a damper. It is used to operate either single or double dampers where the damper is inside of the duct and it is desired that the motor be outside, but attached to the damper frame. Its simplicity of construction commends it, and it is a form quite necessary under certain conditions.



Diaphragm Attachment.

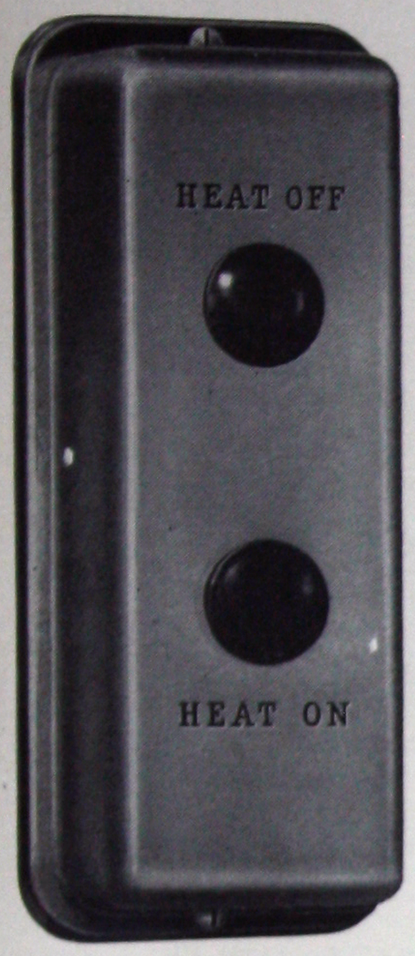
Sylphon Register Attachment



Register Attachment.

This motor is generally used in connection with the dampers of a unit system of heating and ventilating where the motor must be inside of the unit and attached to the metal walls of the unit. It is small and compact and easily attached and is equipped with the Sylphon bellows, insuring long service.

Johnson Pneumatic Switch Control



Model P Push Button.

The air pressure required to operate the Johnson System of temperature regulation also furnishes a very convenient and reliable power for other purposes in the same building. Chief among these is the control of dampers and valves from a central point by means of the Johnson Pneumatic Switches. These switches are connected by small air pipes with pneumatic dampers or diaphragm valves to be operated and which are sometimes distant or inaccessible.

The most important application of the switch control is in connection with modern heating and ventilating plants which require the operation of attic vent dampers, fresh air dampers and riser and blast coil valves from a central switchboard located in a convenient place for the operating engineer or person in charge of the plant. Another important function of these switches is to turn off the air supply to the thermostat when it is desired to permit of heating the building rapidly without being operated by thermostatic control. Sometimes these switches are so arranged that the valves can be controlled either by the thermostat or by the switch as desired to meet conditions.

There are many other applications, however, which are equally important and for which we make the following variety of pneumatic push buttons and switches. *Our* switches, designed for the purposes they are to serve, are neat in appearance and practical in every way. It is our endeavor to assist the engineer in working out improved heating plants and their proper control by furnishing a variety of apparatus.

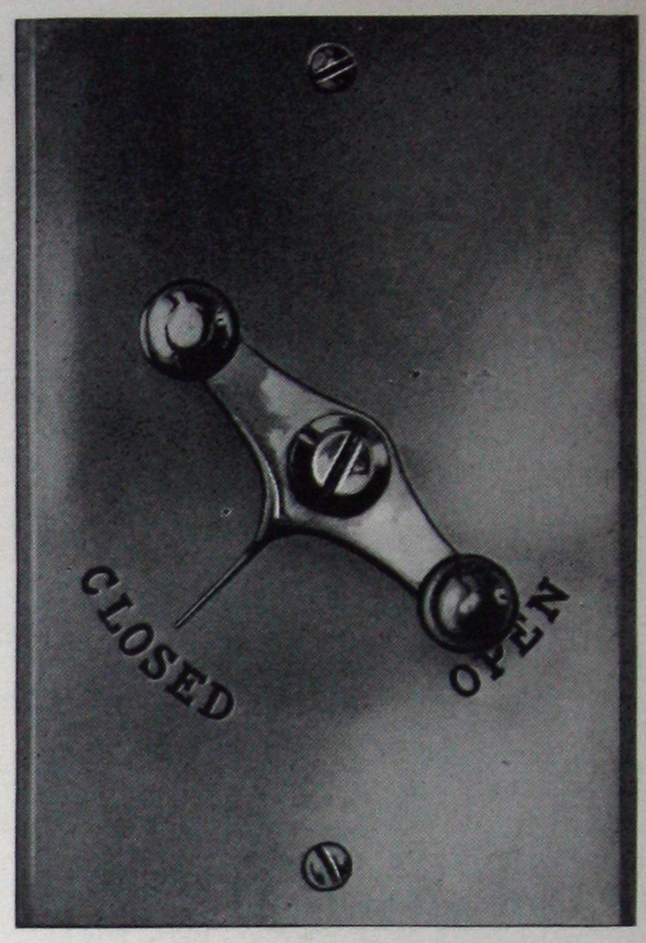
Johnson Pneumatic Push Buttons a Refinement

Push buttons are used mostly in residences, art galleries, bank buildings and other high class buildings having up-to-date systems of heating and ventilating. They are used principally for controlling sky light coils and dampers which are frequently inaccessible. There are, however, a number of other purposes for which they are excellently adapted which will suggest themselves to the consulting engineer. We make two styles; Model P and Model F. The Model P switch extends 1¼″ out from the wall and is designed to be fastened on the same pipe-head as our model thermostat, so that they may be interchanged at will. This switch is small and inconspicuous and is furnished in any finish. The Model F switch is set flush with the wall and has very much the same appearance as an electric switch; it is made either with push button or with toggle switches, as desired, and can be furnished in any desired finish.

Model F Push Button.

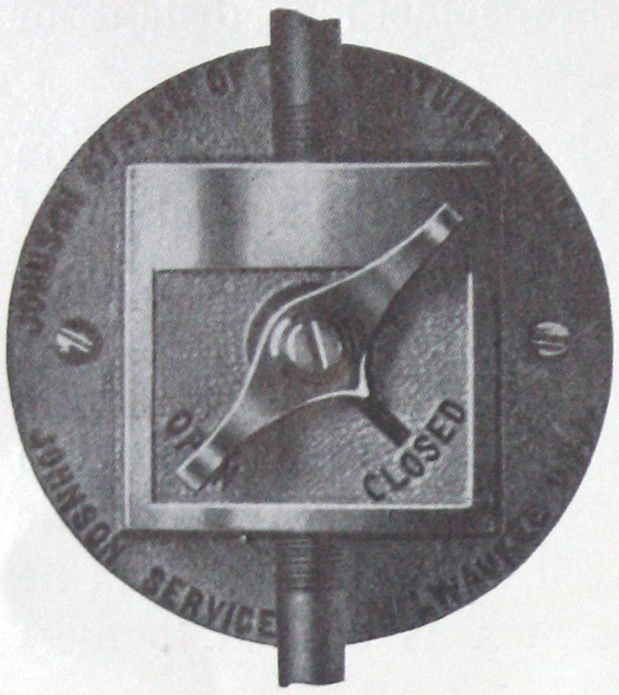
Model FS Flush Switch

The switch at right is adaptable to places where flush type of switch is desired; it has the advantage that it shows from a distance whether the heat is on or off, and can be furnished with a removable handle so that an unauthorized person cannot operate it.



FS Switch.

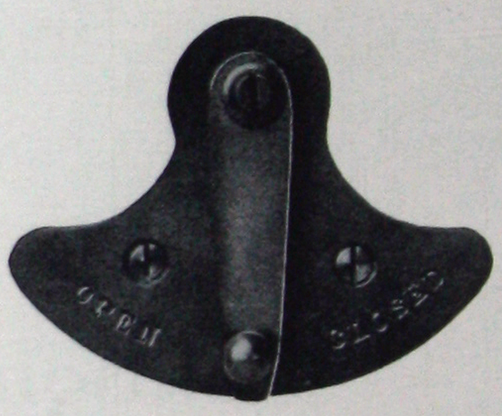
Model BS Box Switch



BS Switch.

This is a simple and compact type of switch for single line control, and especially adapted for small schools where one pneumatic switch is desired to control the attic vent dampers or a number of dampers simultaneously. The fresh air and foul air dampers may be closed and return air dampers opened with one movement of the switch, and vice versa. The switch can be conveniently attached to a brick wall or sheet iron duct.

Lever Switch



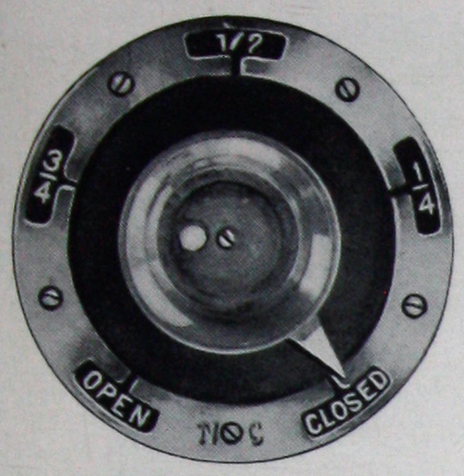
Lever Switch.

This is a lever operated, two, three, or four-way air cock with name plate showing whether air is turned on or off, or whether the damper or valve is open or closed. This switch is generally mounted on a switch board and manipulated by the operating engineer for control of various dampers, valves, etc.

The following is a list of some of the different operations that can be accomplished by these switches:

1. Open or close a valve or damper (2 branch 3-way).
2. Open the valve or damper and close another of same normal position, and vice versa (3 branch 4-way).
3. Main air on branch line to valve or damper or thermostat. No exhaust. (3 branch 3-way).
4. Open valve or damper, or thermostatic control, or close valve or damper. (3 branch 5-way).
5. Connect branch line of either of three pilot thermostats to main air supply of multiple thermostat. (4 branch).
6. Open and close valve or damper from two or more different points. (4-way).

Several other combinations have been worked out, and, in fact, any operation of thermostats, valves or dampers by hand can be accomplished by the use of these switches either singly or in combination.



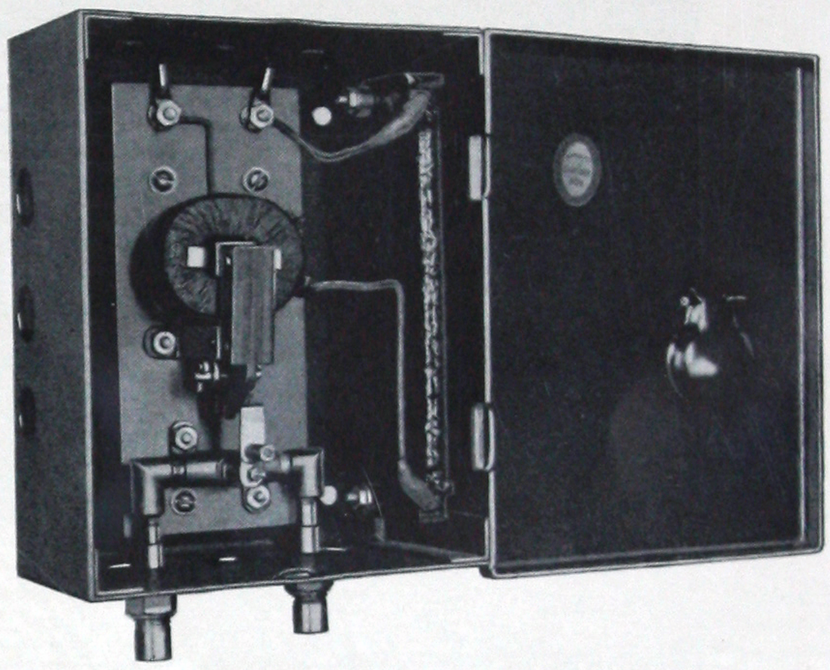
Model Graduating Switch.

Model Graduating Switch

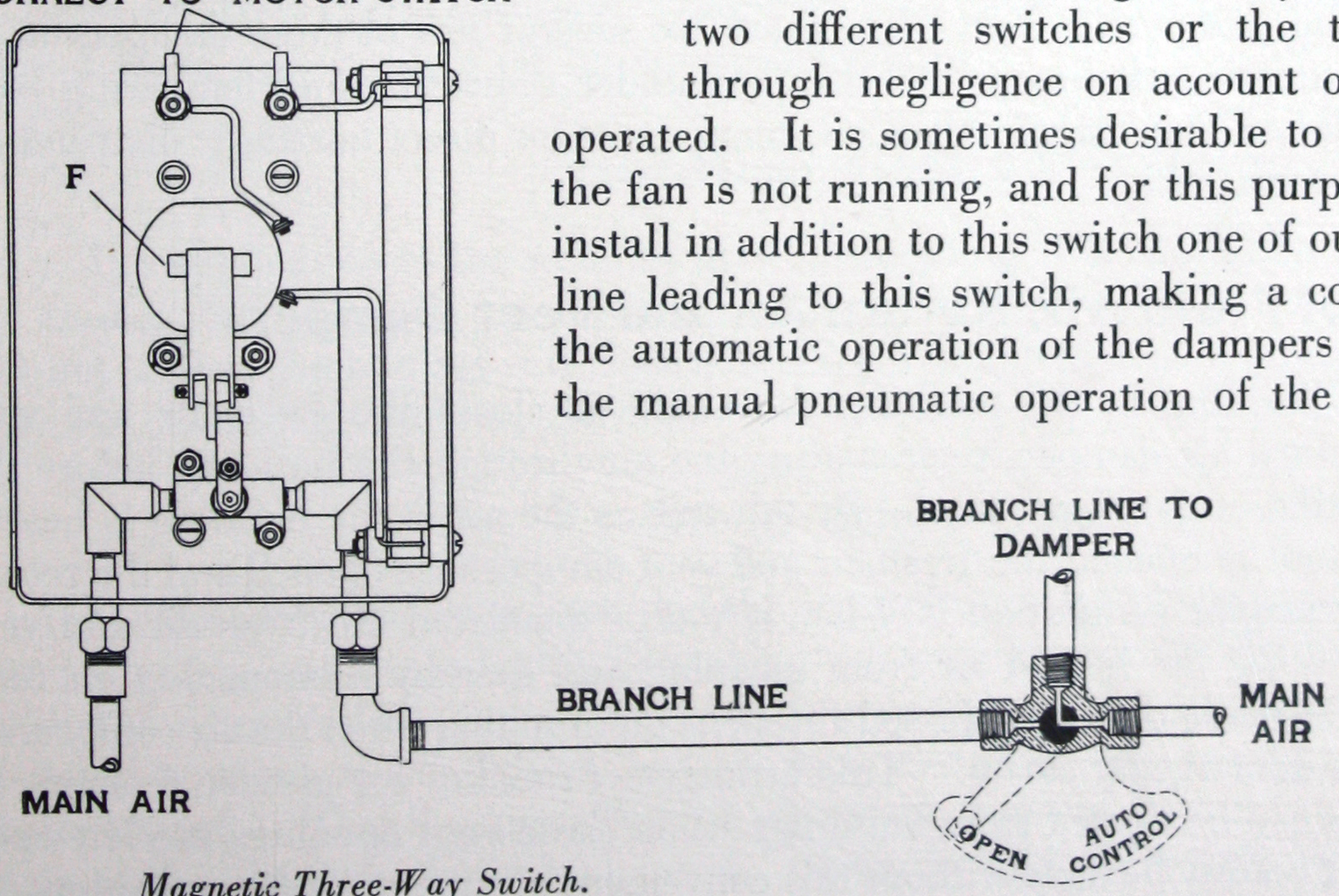
This is a very fine pneumatic switch designed for the purpose of setting dampers in practically any desired position, entirely or partly open or closed. It is frequently used in modern heating plants to reduce or increase the amount of air going into a building or rooms, this being accomplished by partially opening or closing the dampers. With this device the damper can be set in any position from entirely closed to entirely open, and it derives its name from the fact that a glance at the instrument will show the position of the damper. These switches are usually mounted on a switchboard in the engineer's room.

Johnson Magnet Air Switch Solves a Problem

This device is used for automatically operating ventilating dampers when the electric current supplied to a motor operating a ventilating fan or blower is turned on or off. It frequently happens that the ventilating fan for supplying the air to, or exhausting the air from, a building is controlled by a switch placed in the engine room or some other point remote from the fan itself. When the fan is located in the attic, or some other place not convenient to the operator, the electric pneumatic switch can be used to close and open certain dampers when the fan is stopped and started. This device performs that function, automatically opening the dampers when the current is turned on by the switch and closing them when it is turned off, avoiding thereby the necessity of operating two different switches or the trouble that might arise through negligence on account of the dampers not being operated. It is sometimes desirable to open such dampers when the fan is not running, and for this purpose it is only necessary to install in addition to this switch one of our lever switches in the air line leading to this switch, making a condition which permits of the automatic operation of the dampers as the fan is operated or the manual pneumatic operation of the dampers when the fan is idle. This is another instance of the assistance rendered by the Johnson Service Company in solving the problems of consulting engineers.

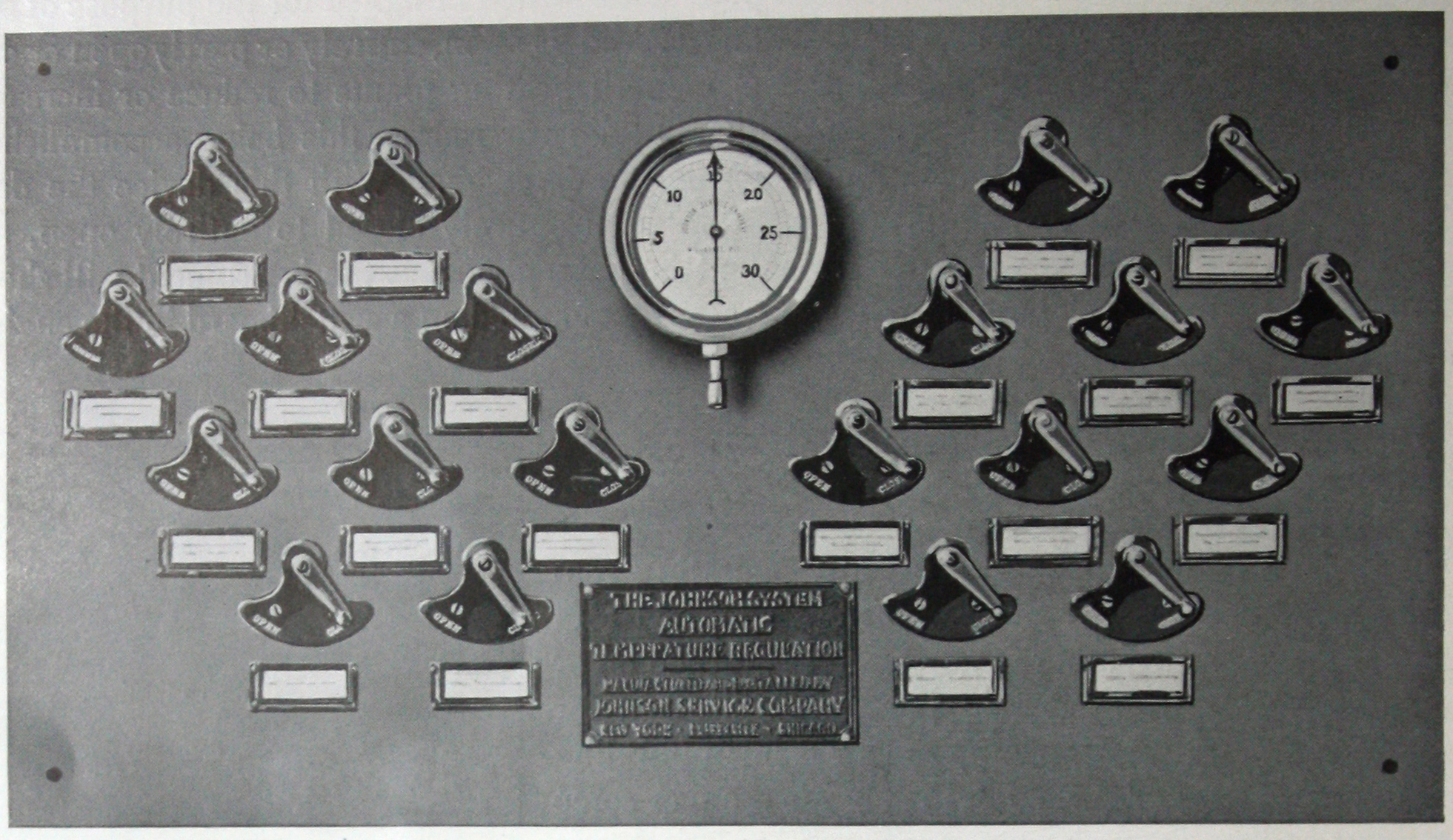


Magnetic Three-Way Switch.



Magnetic Three-Way Switch.

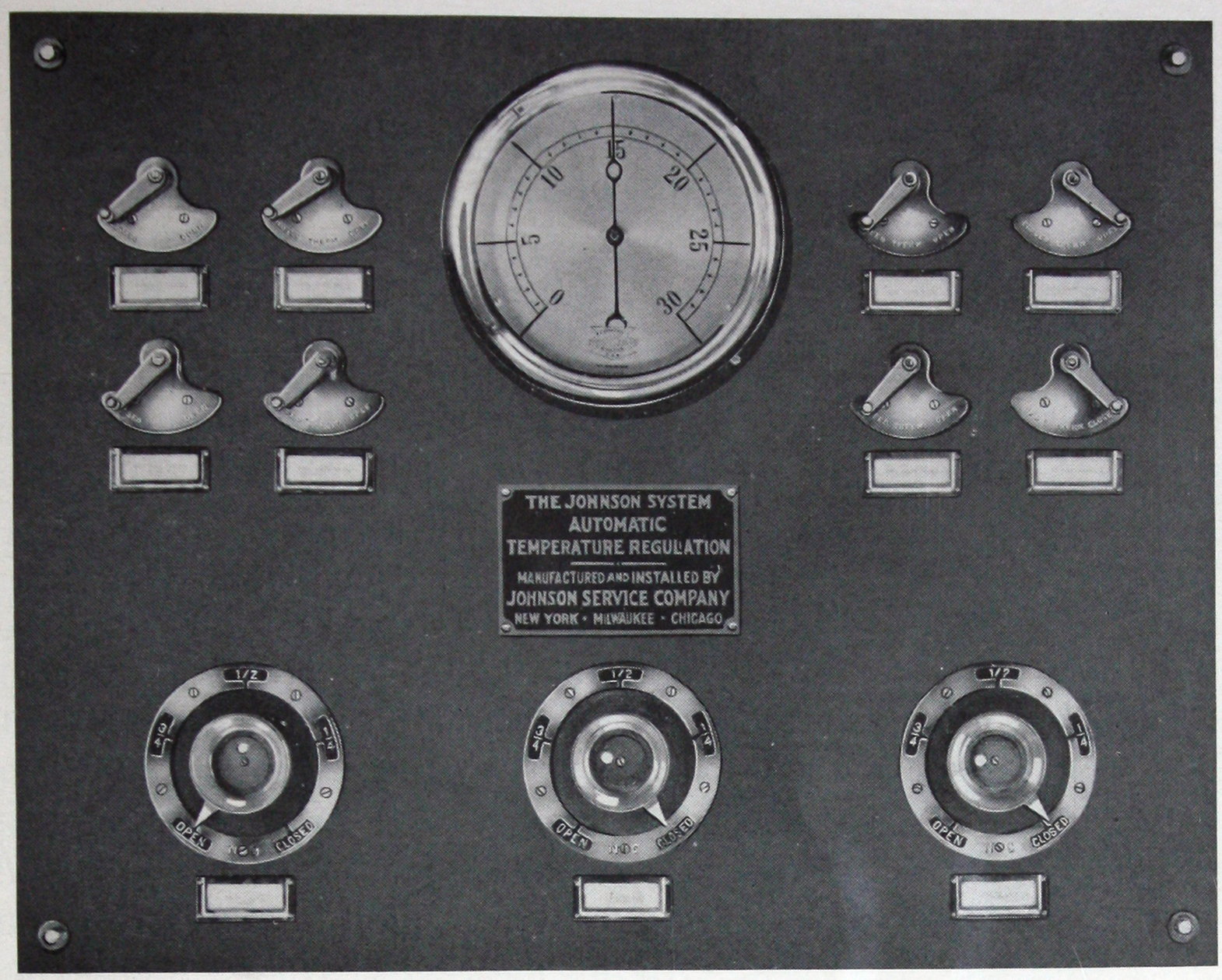
Johnson Pneumatic Switchboards



Our switchboards are made of finely finished oak, oiled slate, imitation or real marble, and are equipped with switches, name plates and trimmings as specified. We illustrate switchboards with our lever handle switch and with our graduated switch. These boards are located at some point convenient for the engineer, and control a number of valves and dampers according to the design of the heating plant. The average school requires pneumatic switch control of the attic vent, fresh air and return air dampers. Very often there are several sets of these dampers to be controlled. Johnson pneumatic switches control dampers under re-heating and tempering coils on hot blast systems; Sylphon diaphragm valves on steam risers for direct heating; distributing dampers on ventilating systems, etc.

Control of Fresh Air, Return Air and Vent Dampers

In heating a school building in the morning the engineer closes the fresh air and vent dampers and opens the return air damper, recirculating the air through the building before the pupils arrive, or when ventilation is not required. By this means the air in the building is heated more quickly. When school is opened the fresh air and vent dampers are opened and the return air damper closed, giving proper ventilation. When school is dismissed the fresh air and vent dampers are closed, preventing the heated air from escaping and thereby economizing on fuel. Vent dampers are usually so made that compressed air opens them so that when the air compressor is shut down the damper automatically closes. This arrangement makes for greater economy as immense quantities of heat can be wasted from buildings when these vent openings are left open unnecessarily, which might readily be done without this convenient arrangement for operation.



Distributing Damper Control for Ventilating Air

Considerable saving may be effected in the operation of heating plants by cutting off the supply of heated or tempered air to those parts of the building where it is not immediately needed, provided there is proper subdivision of the main ventilating air duct into smaller ducts leading to different parts of the building. Dampers may be installed in these branch ducts so that any one of them may be shut off by our switch control.

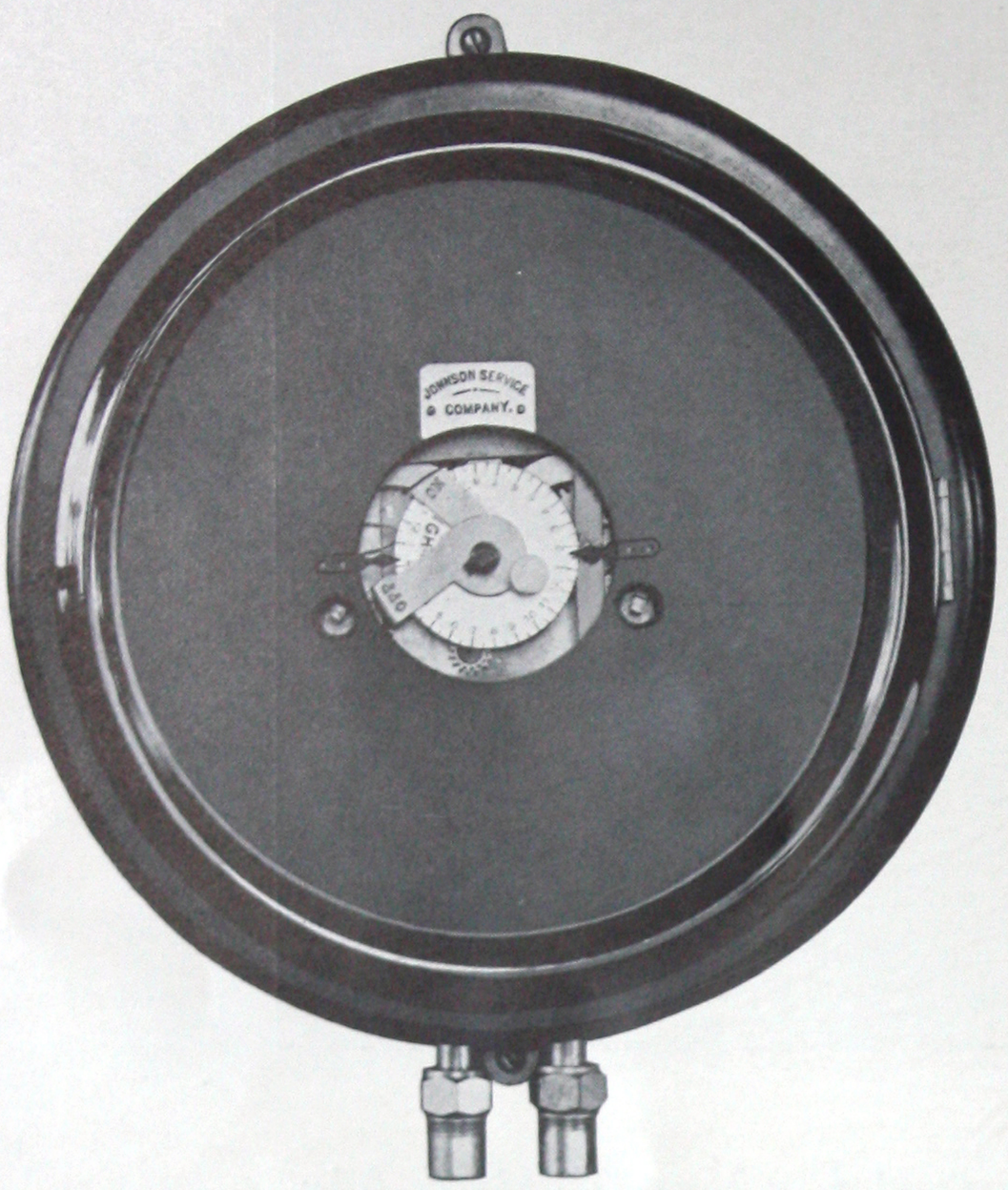
Hot Blast Heating System

The application is the same as above, excepting that the damper under the re-heater may be closed, forcing all the air to pass through the re-heater. The tempered air thermostat can be cut out so that the by-pass will close and steam remain on the tempering coils. All this is to assist in heating the building quickly.

Steam Riser Control

For the same reasons as outlined above, control of the steam supply and return lines to various parts of a building is highly desirable from an economic standpoint. Any part of a building heated by direct radiation may be cut off when not occupied. Even in comparatively small schools it would be more or less difficult to open and close riser valves, whenever desired, without pneumatic control. This is especially true where the overhead system of supplying steam from a main at the top of the building is used. Here the riser valves are located in the attic.

Johnson Night and Day Clock



This instrument is an exceedingly practical and ingenious device for increasing the efficiency and convenience of operation of heating plants. It is distinctly a Johnson device, working on the Johnson pneumatic control principle, applied to an eight-day clock for the purpose of opening and closing dampers, valves, electric switches, etc., at certain times of the day or night.

When used in connection with our system of automatic temperature control for the various purposes stated below, it adds the finishing touch to make the heating plant thoroughly automatic and efficient, and will act as a positive safeguard against waste of heat at times when heat is not needed.

The Johnson Night and Day Clock is a great convenience; it will be especially appreciated by the owner of a residence who is compelled to give more or less of his time to the operation of his heating plant. Aside from this, it has considerable value as a labor saving device and allows the engineer or janitor to devote that much of his time and attention to other purposes. The Night and Day Clock is adaptable to all systems of heating and all classes of buildings where saving in the cost of operation is desirable. The most important applications are given below:

(1) Draft control on boilers and furnaces for residences, schools, etc.

(2) Fuel control on boilers and furnaces for residences, schools, etc.

(3) Control of steam supply to buildings heated by street steam.

(4) Control of fresh air and return air dampers for schools, etc.

(5) Control of fresh air dampers for indirect heating stacks.

(6) Control of electric switch for lights, starting and stopping motors, etc.

(7) Special manufacturing processes requiring time limits for certain operations.

The instrument consists of a very fine eight-day clock movement fitted with our pneumatic valve mechanism and enclosed in a handsome mahogany-finished case with glass cover. The time adjustment is clearly shown in the above illustration and consists of one ON and one OFF cam adjustment within a range of twenty-four hours marked on the time disc. The thumbscrew locks the cams in proper position. Compressed air at fifteen pounds is supplied to the left-hand pipe at the bottom and the other pipe connects to the diaphragm valve or pneumatic damper to be controlled.

Applications of Night and Day Clock

We will be glad to assist in working out methods of applying this useful bit of mechanism to special purposes of any kind. The following applications are in the nature of additions to the Johnson system of temperature control.

(1) Check Draft Control

The clock is located at any place in the house which the owner considers the most desirable or convenient and is connected to a diaphragm motor operating the check drafts on the furnace, steam or hot water boiler, as the case may be. It requires no attention beyond winding once in eight days. Every night it will close the draft on the furnace or boiler at a given time and open it at a given time in the morning. It does not require daily adjustment.

(2) Fuel Control

In place of checking the drafts it is sometimes used for shutting off and turning on natural gas for heating purposes. In this case the clock controls a diaphragm valve on the gas supply pipe.

(3) Street Steam Control

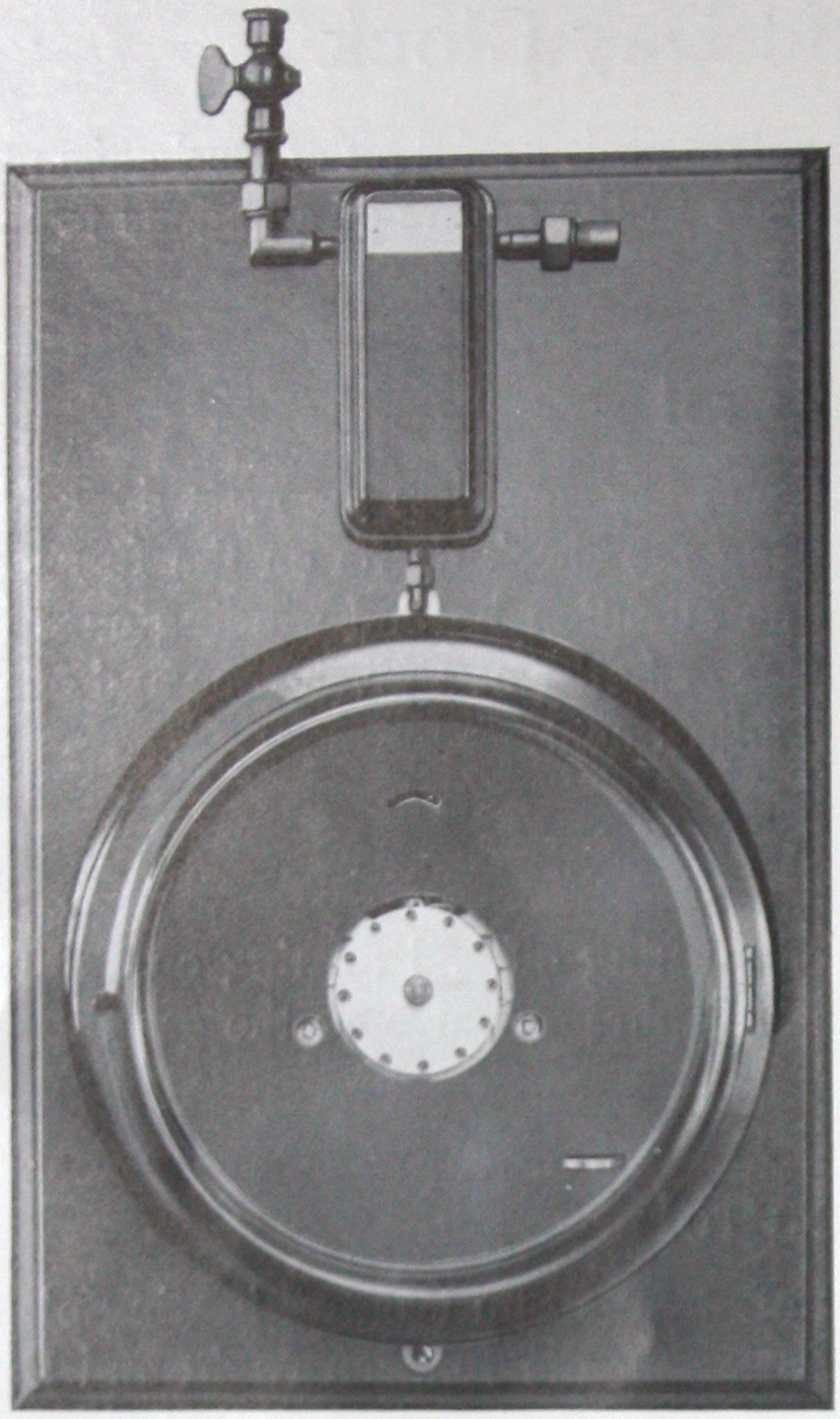
A very considerable saving may be effected in the cost of street steam (central heating plant system) supplied to residences, office buildings, etc., by installing the Johnson Night and Day Clock to control a diaphragm steam valve on the main steam pipe entering the building, thereby keeping the steam supply to the building shut off during the night, when it is not needed.

(4) Fresh and Return Air Damper Control

In connection with fan blast systems of heating for schools it is customary when ventilation is not necessary, to keep the fresh air and vent dampers closed while the class rooms are not occupied, to prevent the escape of heat from the building. At the same time, return air dampers are opened to allow recirculation of the air in the building, which greatly aids in heating the rooms before the pupils arrive in the morning. The night and day clock saves time and money by performing this duty automatically; it closes the fresh air and vent dampers and opens the return air dampers when school closes, and it opens the fresh air and vent dampers and closes the return air damper at the time school convenes in the morning.

(5) Control of Fresh Air Dampers of Indirect Heating Stacks

Many fine residences today are provided with fresh air inlets for each individual heating stack. Night and day clocks are used to control dampers in the fresh air inlets on individual heating stacks, closing the dampers at night and opening them in the morning. This will prevent freezing of the stacks at night, especially hot water heated stacks, when they are shut off. A saving in fuel may be effected in this application; the ventilation is not required at night in most rooms heated by indirect stacks.



Flush Clock.

Johnson Time Flush System

This system is for the purpose of periodically flushing toilets, urinals, etc., directly from the city water supply without the use of any float tanks, flushometer valves or other appurtenances. It is the simplest, most direct and most effective system ever devised for this purpose. There are no delicate float valves to get out of order and cause constant leakage of water and plenty of power is provided to close the water valve and close it tight. Dirt and sand in the water have no effect on the Johnson Flush System. It is especially advantageous for large office buildings, schools, etc., having a large number of toilets.

The Johnson Time Flush system consists of an eight-day clock mechanism, which controls by compressed air a diaphragm valve on the water supply pipe to the urinals or closets. The clock causes the diaphragm valve to open and flush the urinals periodically directly from the city water supply and will maintain the flushing for any length of time that is desired. The full force of the city water pressure is utilized for the cleaning process. When the clock mechanism operates, it opens and closes the diaphragm valve with positive action.

The clock mechanism may be located at any convenient point and but one is necessary for a building of considerable size. The diaphragm valves on the water supply may be arranged with one valve for each set of toilets or one valve for all toilets, causing all to flush together from one valve located in the basement, depending on the height of building, number of toilets, etc.

Policy of Sale and Installation

We will sell these outfits complete, including the clock, valve and air compressor, or any part thereof. There are many purposes for which a time valve mechanism of this sort may be used to meet the various requirements of our customers. The greatest advantage will be found in buildings having available compressed air of at least fifteen pounds per square inch, thereby saving the cost of a separate compressor.

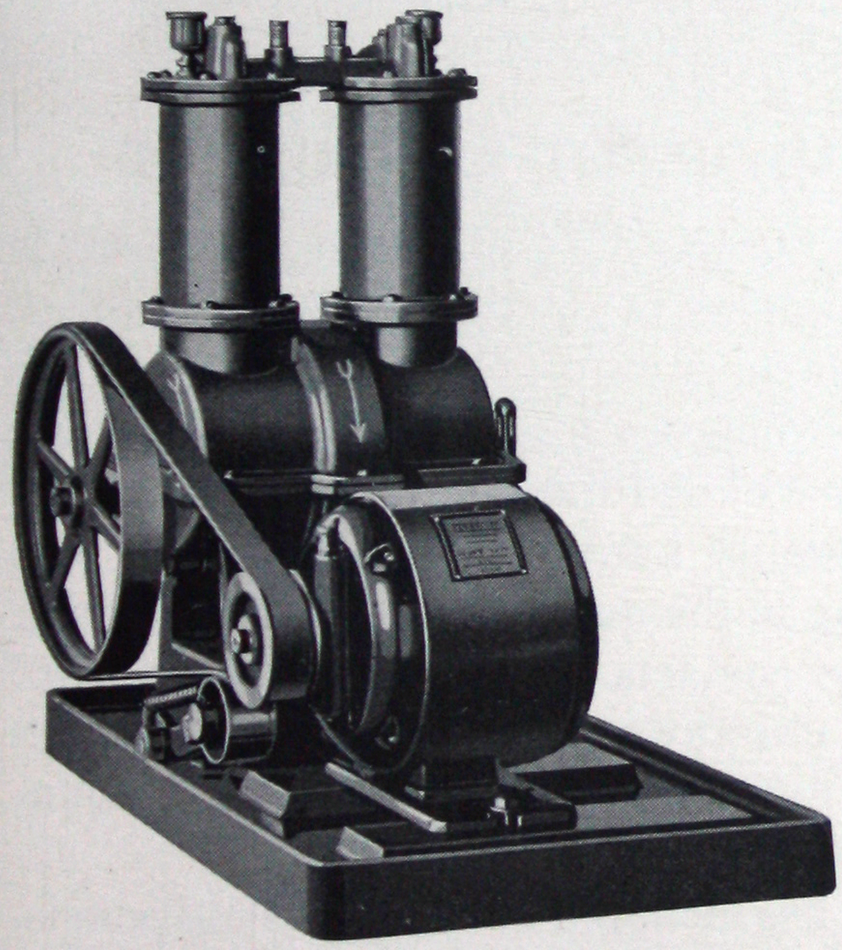
We will gladly contract to install the Johnson Night and Day Clock or the Johnson Time Flush System in buildings equipped with our system of Automatic Temperature Regulation. Similar installations can be made in other buildings where air pressure is available. Architects and owners will find them of great advantage in promoting health, comfort and economy.

The Compressed Air Supply

Johnson Pneumatic Thermostats must be supplied constantly with air at low pressure (fifteen pounds). They require very little air, and a comparatively small air compressor can be used. The available motive power and the size of the installations are the determining factors in the selection of an air compressor. The compressor may be operated by electricity, steam or water, or driven by belt; and in every case a suitable governing device is furnished to automatically start and stop the compressor to maintain a constant pressure in the system.

To assist in the choice of the proper air compressor to be specified in connection with our thermostats, pneumatic switch control, humidity control, etc., we illustrate and describe on the following pages the different air compressors we manufacture. Every compressor is automatic in operation and requires no attention beyond the ordinary care of oiling and cleansing.

Electric Air Compressors



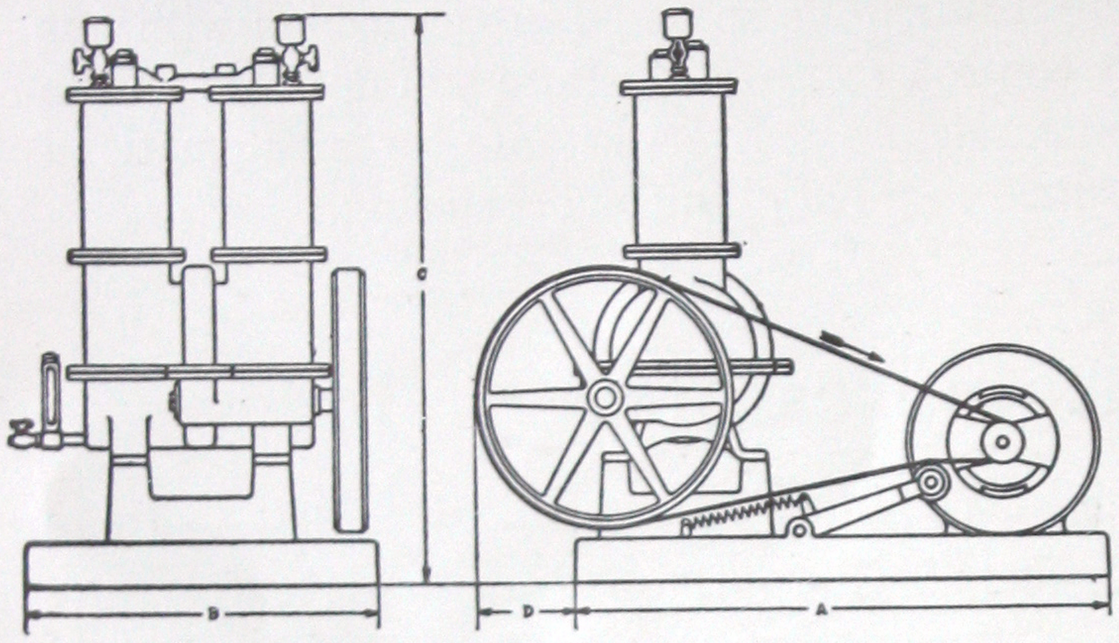
Electric Air Compressor.

Our belted electric air compressor is designed and built by us solely for the purpose of automatic temperature regulation. It represents the very best in the art of machine design and the very latest machine shop methods are employed in making and assembling the various parts. We guarantee it to be the most efficient and best constructed low pressure compressor on the market. Mounted on a single cast iron base with the motor and an idler pulley for keeping the belt tight, it makes a very neat and compact unit as nearly fool-proof as it is possible to make such a machine.

The cylinders and heads are removed readily, exposing the interior parts. The connecting rods, cranks, crank bearings and gears run in oil, thereby reducing the wear of parts to the absolute minimum. Connecting rods are made of phosphor bronze. Pistons are provided with three rings and are made of the best grade of soft gray iron ground to fit the cylinders perfectly. The cylinders are soft gray iron, ground to size. Check valves are cast of hard, tough bronze to withstand wear from long service; they are mounted directly in the head of the cylinders, thereby reducing the clearance space to the minimum and giving the greatest efficiency of compression. The driving gears are cut spiral in accordance with the latest approved practice, and are noiseless. By gearing the air compressor down in this noiseless manner we are able to use a high-speed electric motor, which secures greater efficiency in power and greater economy in current consumption. The one piece crankshaft is turned from a drop forging of high-grade steel and is ground to fit the bearings.

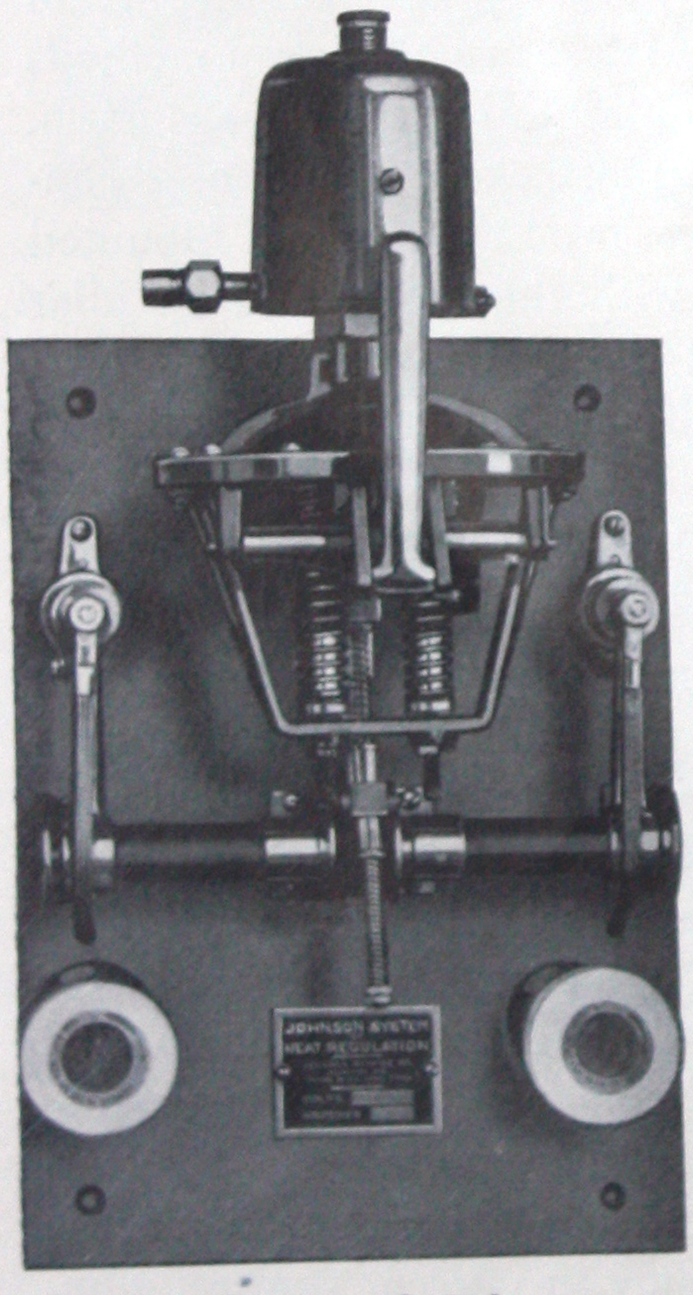
Johnson Belted Electric Air Compressors

Type of Compressor	Capacity Cubic Inches Free Air Per Minute	Air Pressure Pounds Per Square Inch	Horsepower of Electric Motor	Speed of Motor in Revolutions Per Minute
3 x 3	3,500	15	¼ D. C. ¼ A. C. ½ D. C.	1,800
4 x 4 A	6,500	30	½ A. C. ½ D. C.	1,800
4 x 4 B	7,600	15	½ A. C. ¾ D. C.	1,800
4 x 4 C	10,000	15	¾ A. C.	1,800



For convenience in making plans and specifications of the foundation for the air compressors and its location in the building, the following over-all dimensions will prove handy:

Type	A	B	C	D
3 x 3 A	21 in.	14 in.	22¼ in.	4 in.
3 x 3 B	21 in.	14 in.	22¼ in.	4 in.
4 x 4 A	28 in.	18 in.	27 in.	5¾ in.
4 x 4 B	28 in.	18 in.	27 in.	5¾ in.
4 x 4 C	28 in.	18 in.	27 in.	5¾ in.



Governor Switch.

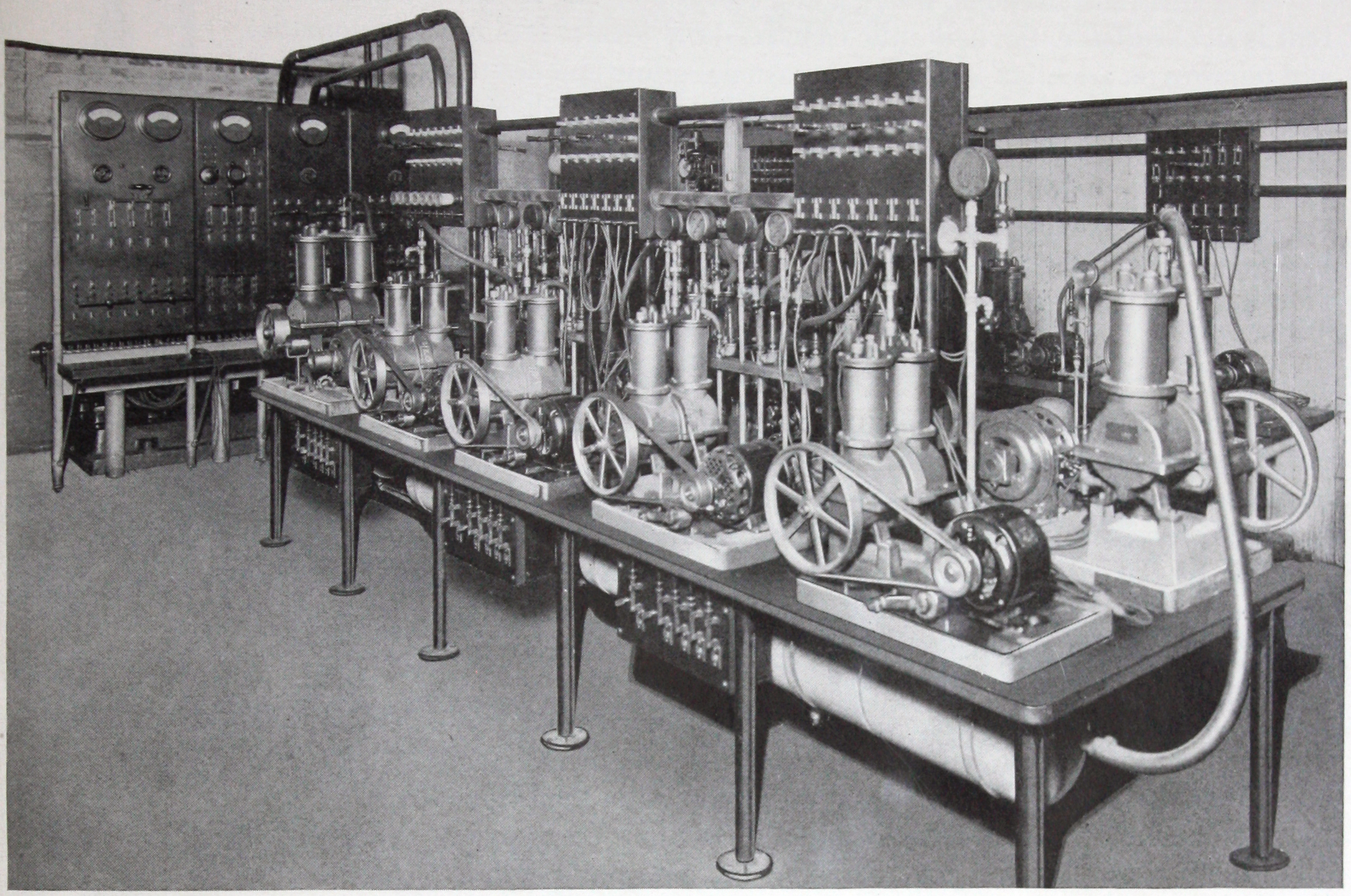
Electric Compressor Governor

In connection with our Electric Air Compressors, we provide two-, three- and four-pole switches of the type shown in the cut, adapted to the type of motor operating the compressor and the current supplied. These switches are reliable in their action, giving firm, tight contact when closed and quick, wide break when opened. Only the best quality hard bronze and carbon butt contacts are used, and owing to the quick, wide break, no arcing can take place to burn the contacts. THESE SWITCHES ARE REGISTERED WITH THE UNDERWRITERS' LABORATORIES IN CHICAGO AND COMPLY IN EVERY RESPECT WITH THE UNDERWRITERS' RULES.

Our standard switches are mounted on Monson slate panels. Metal parts are highly polished brass, making a neat and finished looking piece of apparatus. A hand lever cut-out is provided for opening the switch independently of the governor.

The dome-shaped iron shell at the top of the switch contains the governor, operating switch to close at 12½ pounds air pressure and to open at 15 pounds air pressure. It is not practical to control electric compressors closer than 2½ pounds, owing to unnecessary starting and stopping. This is especially true of single-phase motors.

The governor is a unit in itself and may be used in connection with steam supply valves for controlling steam operated air compressors or water supply valves for hydraulic air compressors.



Electric Test Room for Air Compressors.

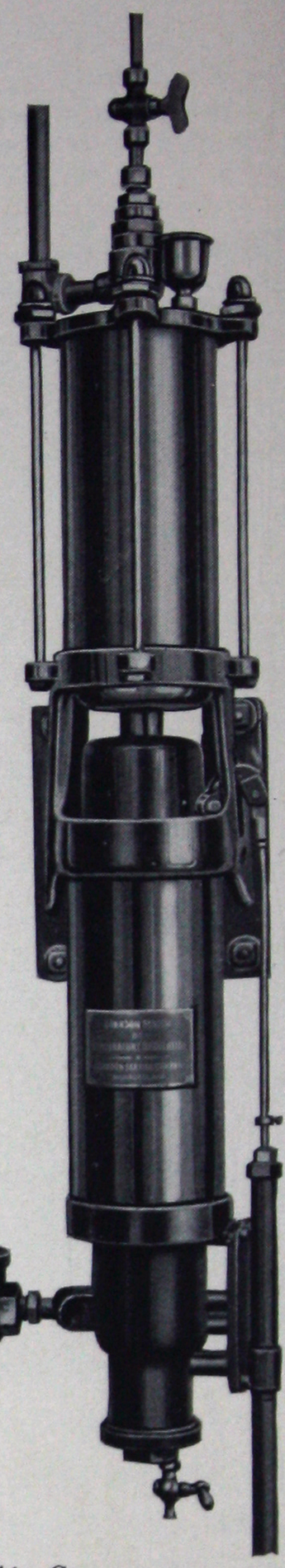
Compressors and Motors Severely Factory Tested

Each electric air compressor and motor is given a severe test before leaving the factory. The air compressors are belt driven for a period of thirty-six hours and tested carefully for capacity and any defects that might appear in the cylinders or bearings. The motors are given a special test for heating under load conditions in our electric department and they are not permitted to go out unless they show less than 30°C. temperature rise after eight hours' continuous running at full load. After the air compressor is assembled with its motor, the entire machine is given a 36 hour test for its performance in operating with its own motor.

We have spent large sums of money in perfecting our testing laboratory and can furnish from one switchboard electric current of any voltage, cycle and phase.

Hydraulic Air Compressors

For small installations, where a first cost is a factor, or where electric current is not available, the hydraulic compressor is ideal; it is quiet, automatic, and requires no attention beyond an occasional oiling and cleaning. It is operated by water pressure, available in every district as a cheap and convenient source of power. No governor is required to regulate the air pressure. A simple reducing valve in the water supply line regulates the supply of water at the proper pressure to the compressor, permitting the latter to compress air to just fifteen pounds, and no more. Any sediment in the water accumulates in a filter in the feed water line. This filter is easily cleaned.

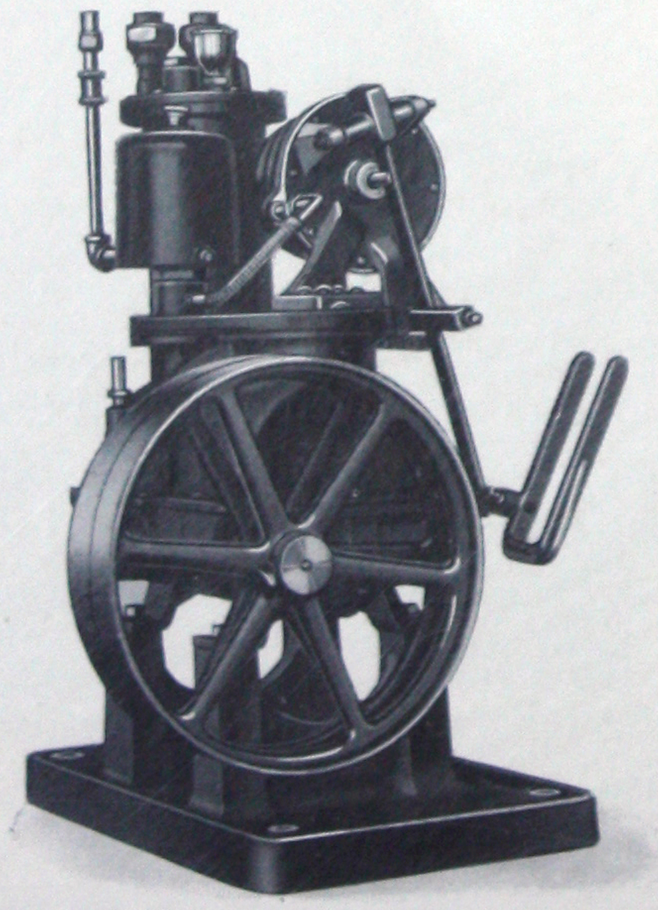


Hydraulic Air Compressor.

Steam Air Compressors

The Johnson Service Company does not manufacture steam air compressors, but they are frequently specified by engineers of plants in which the conditions make a steam compressor desirable, and we will furnish any make or size of steam air compressor required by the specifications. If no make is specified, we will provide a steam air compressor of the best possible make on the market that in our judgment is of sufficient size to operate the plant in the most economical manner.

The method of mounting the steam air compressor is outlined by the specification, but these machines are usually mounted on either a concrete foundation or on wall brackets in the engine room. We include in the installation of a steam air compressor all of the necessary valves, governors and oiling devices required by the best engineering practice. We guarantee the operation of such compressors in the same manner as if manufactured in our own factory.



Belted Air Compressors

Belted air compressors are frequently required in buildings where neither steam, electricity nor water power is practical or available. Many buildings are provided with a furnace blast heating and ventilating system and in such cases a compressor driven from the shaft of the ventilating fan is used. Belted air compressors are not designed for large plants, but for small installations they are ideal.

The belted compressor designed and furnished by us is in reality one of our electric air compressors with one cylinder eliminated. The base, compressor governor and belt shifter are combined in one unit as shown in the illustration.

Reducing Valves

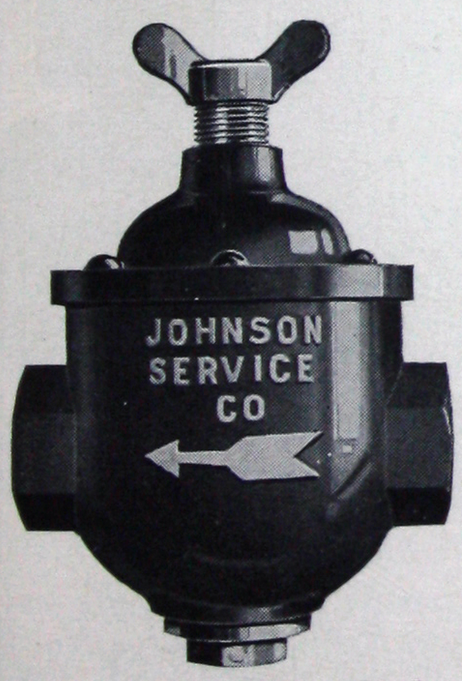
In connection with the Johnson System of Temperature and Humidity Control, we have found it necessary to manufacture reducing valves for air and water. The kind we are able to get on the open market do not possess the qualities of accuracy, durability and finish to correspond with the other parts of our system.

Among other things required of air and water service is a valve which is tight when closed and will not permit the pressure to increase on the discharge side. It is important to have a reducing valve which will allow free passage of air or water without causing any appreciable drop on the low pressure side when the valve is subjected to sudden and heavy service.

The materials used in the manufacture of our reducing valves are the very best for the purpose, combining durability and utility. The body casting is of the best grade of soft gray iron finished in two coats of baked glossy black japan. Adjusting screw, yoke, disc holder, stem and valve seat, contain the best grade of brass and bearing metal. The rubber diaphragm is made of pure Para gum, reinforced with two layers of fabric.

Because of these qualities the valve is desirable for many other purposes than in connection with the Johnson System. We have therefore placed on the market a line of Johnson reducing valves of three different styles from 3/8″ to 2″ in size, for the pressure regulation of air, gas or water. We will be pleased to quote prices and discounts in quantities on application.

No. 1 Pressure Reducing Valves



Pressure Reducing Valve No. 1.

No. 1-A for Air.
No. 1-W for Water.

This is a small compact valve 5″ high and 3″ in diameter, finished in black japan and furnished with brass adjusting screw; it is made with the same care and of the same high grade materials used in all of our reducing valves, and is guaranteed to regulate accurately and constantly.

Type	Size	Maximum Pressure	Low Pressure Range
1-A	3/8″	100 pounds	100 to 5 pounds
1-A	1/2″	100 pounds	100 to 5 pounds
1-W	3/8″	100 pounds	100 to 5 pounds
1-W	1/2″	100 pounds	100 to 5 pounds

Pressure Reducing Valve No. 2.

No. 2 Pressure Reducing Valve

No. 2-A for Air.
No. 2-W for Water.

What we have said on the preceding page concerning the material and service rendered by the No. 1 Reducing Valve will apply equally well to this type of valve. Both types include the ½″ pipe size and for proper use the choice between them rests in the following features:

The No. 1 Pressure Reducing Valve is smaller, lighter, simpler in design, and is, therefore, less expensive. The No. 2 Reducing Valve, shown at the left, has a more finished adjusting screw provided with black japanned wood palm-piece. It is also provided with an extra catch bowl at the bottom with drain plug for catching and removing dirt from the valve. A brass drain cock will be provided with this valve at extra cost.

Style	Size	Maximum Pressure	Low Pressure Range
2-A	½″	100 pounds	100 to 5 pounds
2-A	¾″	100 pounds	100 to 5 pounds
2-W	½″	100 pounds	100 to 5 pounds
2-W	¾″	100 pounds	100 to 5 pounds

No. 3 Pressure Reducing Valve

No. 3-A for Air.
No. 3-W for Water.

The No. 3 Pressure Reducing Valve is a positive shut-off valve, identical in design and construction with the No. 2 Valve, but built of heavier material and for pipe sizes of 1″, 1¼″, 1½″ and 2″. Cap Screws replace the round headed screws on the No. 2 Valve. Our stock valve has the body cast in soft gray iron finished in baked glossy black japan. The adjusting screw, stem, yoke, disc and seat are made of the best grade of brass and bearing metal.

Style	Size	Maximum Pressure	Low Pressure Range
3-A, 3-W	1 ″	125 pounds	100 to 5 pounds
3-A, 3-W	1¼″	125 pounds	100 to 10 pounds
3-A, 3-W	1½″	125 pounds	100 to 15 pounds
3-A, 3-W	2 ″	125 pounds	100 to 20 pounds

Pressure Reducing Valve No. 3.

Guarantee

Johnson reducing valves are guaranteed against original defects of material and workmanship. All parts are interchangeable. The superiority of Johnson valves lies in their simplicity of design, stiffness and strength of parts when subjected to pressure or strain. We use the best grade of materials for parts subjected to wear or deteriorating influences.

The Johnson System of Humidity Control

The Johnson System of Humidity Control comprises means for supplying moisture (humidity) to the heated air in buildings and means for automatically maintaining the humidity at the correct percentage.

Humidity: Vapor content of air is explained by the law of hygrometry, which says: THE WEIGHT OF WATER VAPOR WHICH A GIVEN SPACE WILL HOLD IS ENTIRELY DEPENDENT UPON ITS TEMPERATURE. This definition may be read as follows: THE WEIGHT OF WATER VAPOR WHICH AIR WILL HOLD IS ENTIRELY DEPENDENT UPON THE TEMPERATURE OF THE AIR. The colder the air, the less moisture it will hold; the warmer the air, the more moisture it will hold.

DRYNESS is measured by the capacity of air, or in reality the demand of air for moisture. This demand is produced in buildings by heating the cold outdoor air to a temperature from 50 to 70 degrees higher, at which temperature the demand of the air is for ten to fifteen times the weight of moisture contained in the original volume by weight per cubic foot. If this demand is not satisfied by artificial means the air will draw its moisture from the contents of the building, to the detriment of everything it reaches. To the physical sense this demand is recognized as DRYNESS.

Relative Humidity: IS EXPRESSED IN PERCENTAGE AND IS THE PROPORTION BY WEIGHT OF THE MOISTURE IN THE AIR AT A GIVEN TEMPERATURE TO WHAT IT WOULD CONTAIN IF THE AIR WERE SATURATED AT THAT TEMPERATURE.

The average relative humidity of *outdoor* air in the temperate zone with few exceptions is greater in winter than in summer. In summer-time we live practically out of doors and are surrounded with air having a relative humidity of from forty to eighty per cent, or more. In winter we have an average relative humidity of seventy per cent in the outdoor air, but as we cannot live comfortably in these low temperatures, we heat this air to a summer temperature and pass it into our buildings, consequently the relative humidity of the heated air in our buildings during the winter months is very low; and the colder the outdoor air, the lower it becomes. The AVERAGE relative humidity indoors ranges between ten and twenty per cent. THIS MEANS A DRYNESS OF THE AIR GREATER THAN THAT OF DESERTS AT THEIR DRYEST, MOST ARID PERIODS. Although the average relative humidity is too low, nevertheless, we have to deal with EXTREMES, because a week, or even a few days, of severely cold weather will work harm by the excessive dryness of indoor air.

Starting with zero temperature outdoors, we find that saturated air at 0 degrees F. contains approximately .5 grains of moisture per cubic foot. If the air is now heated to 70 degrees F. the weight of moisture in the air remains the same, but the capacity of the air at 70 degrees F. to absorb moisture to the saturation point is increased to 8 grains per cubic foot. Referring to the above definition of relative humidity, we have the following answer: RELATIVE HUMIDITY INDOORS = .5 ÷ 8 = 6%.

Thousands of dollars are spent upon the installation of heating plants in modern buildings for the comfort of the occupants. It has been assumed that when a temperature of 70 degrees F. can be maintained during the cold winter months, summer conditions have been obtained from a winter climate. A greater mistake was never made, yet people persisted in this belief for many years. While apparently comfortable conditions were maintained, people did not attribute their ills and discomforts in any way to the artificial heating system causing a lack of sufficient moisture in the air.

The evaporation of moisture from our skin produces a decidedly cooling effect. This explains why we sometimes feel chilly, although the temperature indoors is 70 to 73 degrees F., while at other times we feel too warm at a temperature above 67 degrees F. In the first case the air is too dry and in the second case the air probably contains the right amount of vapor, but the temperature is too high. We are accustomed to have our buildings heated from 70 to 73 degrees F., and as a result we have been living in a very dry atmosphere. If the relative humidity of the air is maintained constantly at forty-five per cent we will feel just as warm at 66 degrees F., or approximately 5 degrees lower temperature. It takes an appreciable amount of coal to raise the temperature of air in large volumes through these additional 5 degrees and to maintain it there. Proper humidification results in a marked saving in the cost of operating the heat plant.

The first installations supplying moisture to the air under the control of humidostats and thermostats were made by us and proved so successful and beneficial that hundreds of buildings have since been so equipped.

We fought hard to introduce automatic temperature regulation and humidity control. Now they are universally specified for schools, public buildings and the better class of residences, both here and abroad. We strived to prove the necessity of introducing moisture into the heated air of buildings to protect the health of the occupants and to insure the preservation of property. Today the question of proper humidification of air in buildings is being given the greatest consideration in connection with the modern systems of heating and ventilating.

Temperature regulation and humidity control now work hand in hand for the betterment of health, comfort and economy. Both are required in order to obtain artificial ideal atmospheric conditions. Humidity control is especially dependent upon proper temperature control in maintaining the desired percentage of moisture in the air, and for this reason it should be specified in connection with automatic temperature regulation.

Humidostat

Room Humidostat.

This instrument was patented and the word HUMIDOSTAT was copyrighted by the inventor, Professor Warren S. Johnson. The name has been incorporated in Webster's Dictionary and defined as an instrument for regulating the amount of moisture in the air of buildings. This refers to the Johnson Humidostat, and if it is not a Johnson it is not a HUMIDOSTAT.

The operation of the humidostat is the same as that of the pneumatic thermostat; it operates a Sylphon bellows valve on the feed pipe to a humidifier. The humidifiers are usually located in the main air duct supplying air to the building, but sometimes are located in the room to be humidified. When more moisture is needed the humidostat opens the valve and when the air has received a sufficient amount of moisture the humidostat closes the valve.

Like the thermostat, the humidostat is made to be located on the wall of a room or inserted in an air duct, both types being made like the thermostats to act either positively or intermediately.

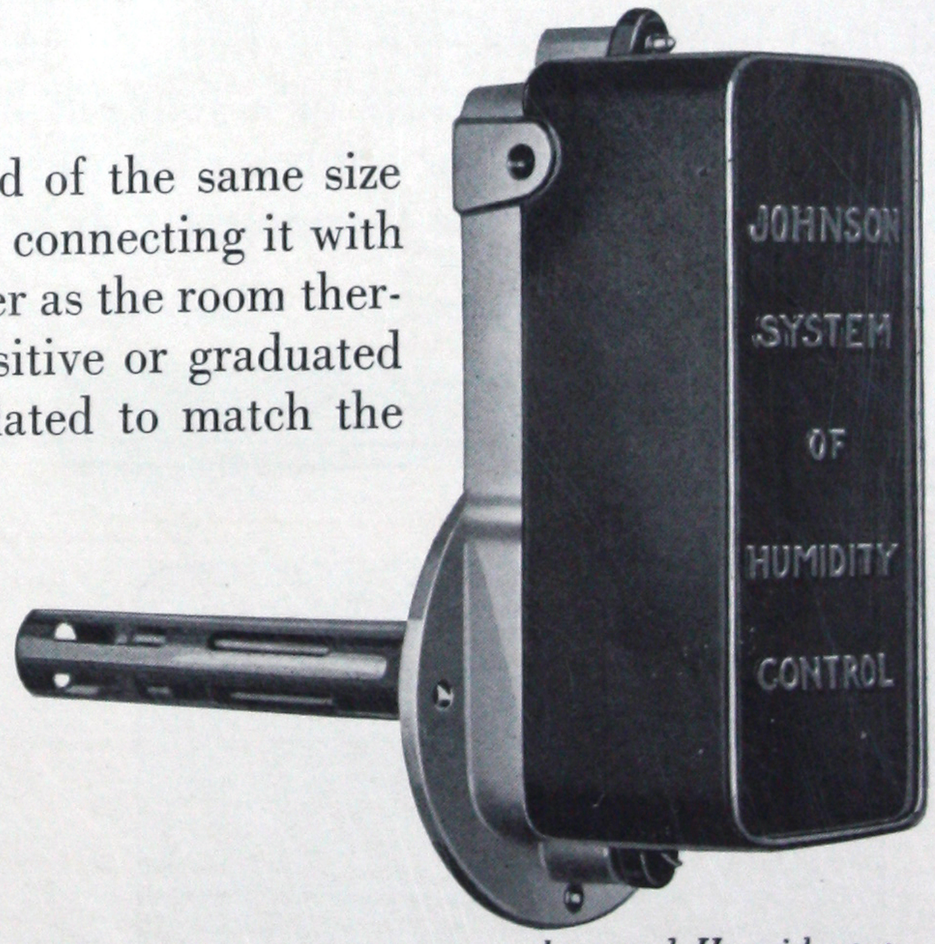
To secure the best results with humidity control, it is necessary that the temperature within the building be maintained at a constant degree with automatic temperature regulation, and where our system of temperature control is installed the humidity control may be added at very little extra expense.

Room Humidostat

The room humidostat is similar in appearance and of the same size as the model thermostat and is attached to the piping connecting it with the Sylphon valve to be controlled in the same manner as the room thermostat. The room humidostats are made either positive or graduated acting, as conditions require, and the covers are plated to match the hardware finish, when so desired.

Duct Humidostats

These humidostats are similar in appearance to the inserted type of thermostats, having the sensitive element inserted into a duct or plenum chamber through a wall, leaving the mechanism outside for adjustment and observation. These instruments are also made in both the graduating and quick-acting types.



Inserted Humidostat with Cover.

Positive Quick-Acting Humidostat

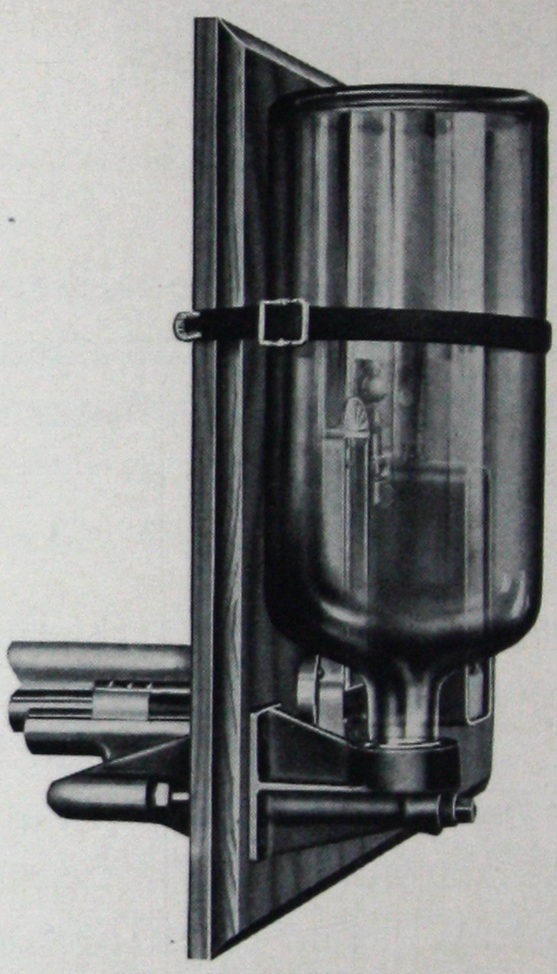
When pan humidifiers are used, it is almost always advisable to use the quick-acting humidostat for the reason that comparatively high steam pressure must be used in the coils to cause sufficient evaporation of the water. The steam valve on the coils should be immediately opened and to the full extent and closed quickly and positively to prevent wiredrawing of the valve. The body of steaming water in the pan serves to graduate the action of the humidifier. Electrically heated and gas heated pan humidifiers should be controlled with positive, quick-acting humidostats.

Graduated-Acting Humidostat

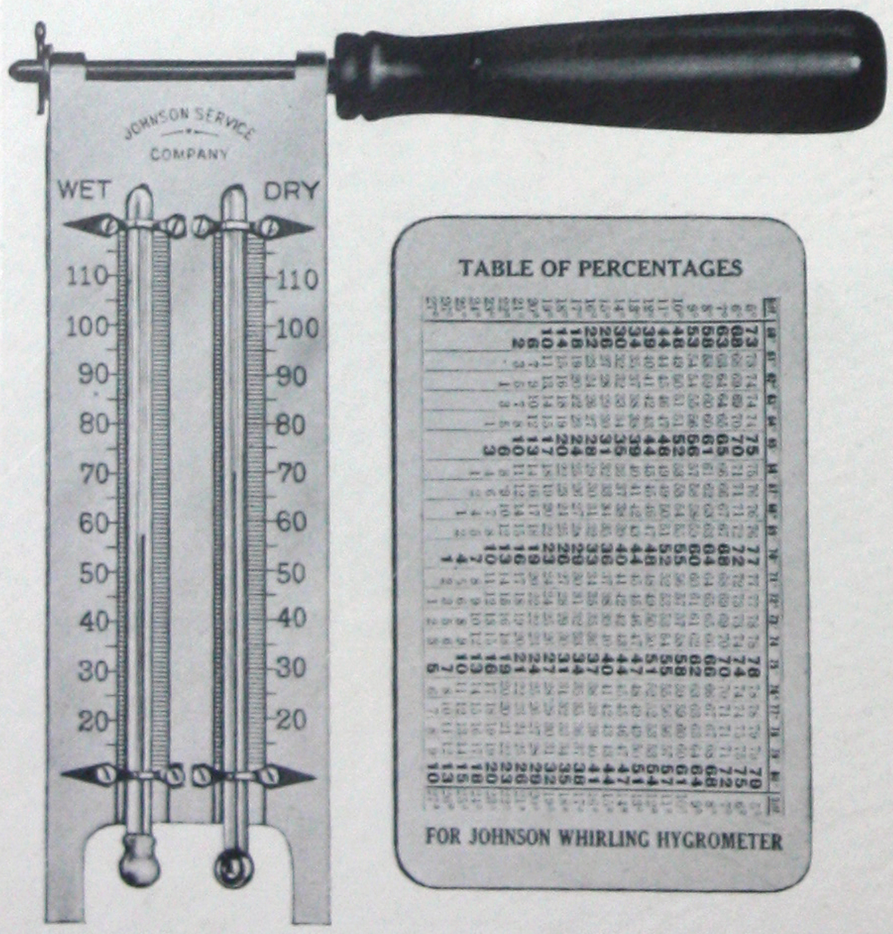
When perforated steam pipe humidifiers are used to supply moisture to the air in connection with hot blast heating systems or direct heating with tempered fan ventilation, it is often desirable to use a graduated-acting humidostat operating our special graduated-acting diaphragm valve on the steam supply pipe. Very close results may be obtained in the regulation of humidity; the valve will open just the right amount to supply the required moisture to the air. THE STEAM PRESSURE SHOULD BE REDUCED TO AT LEAST FIVE POUNDS PER SQUARE INCH BEFORE PASSING TO THE HUMIDIFIER.

Wet Bulb Thermostat a Humidostat

The wet bulb thermostat functions as a humidostat when properly applied. It has been found that humidostats are not efficient at high temperatures and high humidities. The use of the humidostats described above is confined to temperatures below 100 Fah. and humidities below 70%. Where it is desired, as is often the case in industries, to control a high percentage of humidity, at high temperatures, the wet bulb thermostat has been invented and designed. It consists of a Johnson inserted tube thermostat supplied with means for applying the wet bulb temperature to the sensitive element of the thermostat. It is a well made instrument and highly efficient.



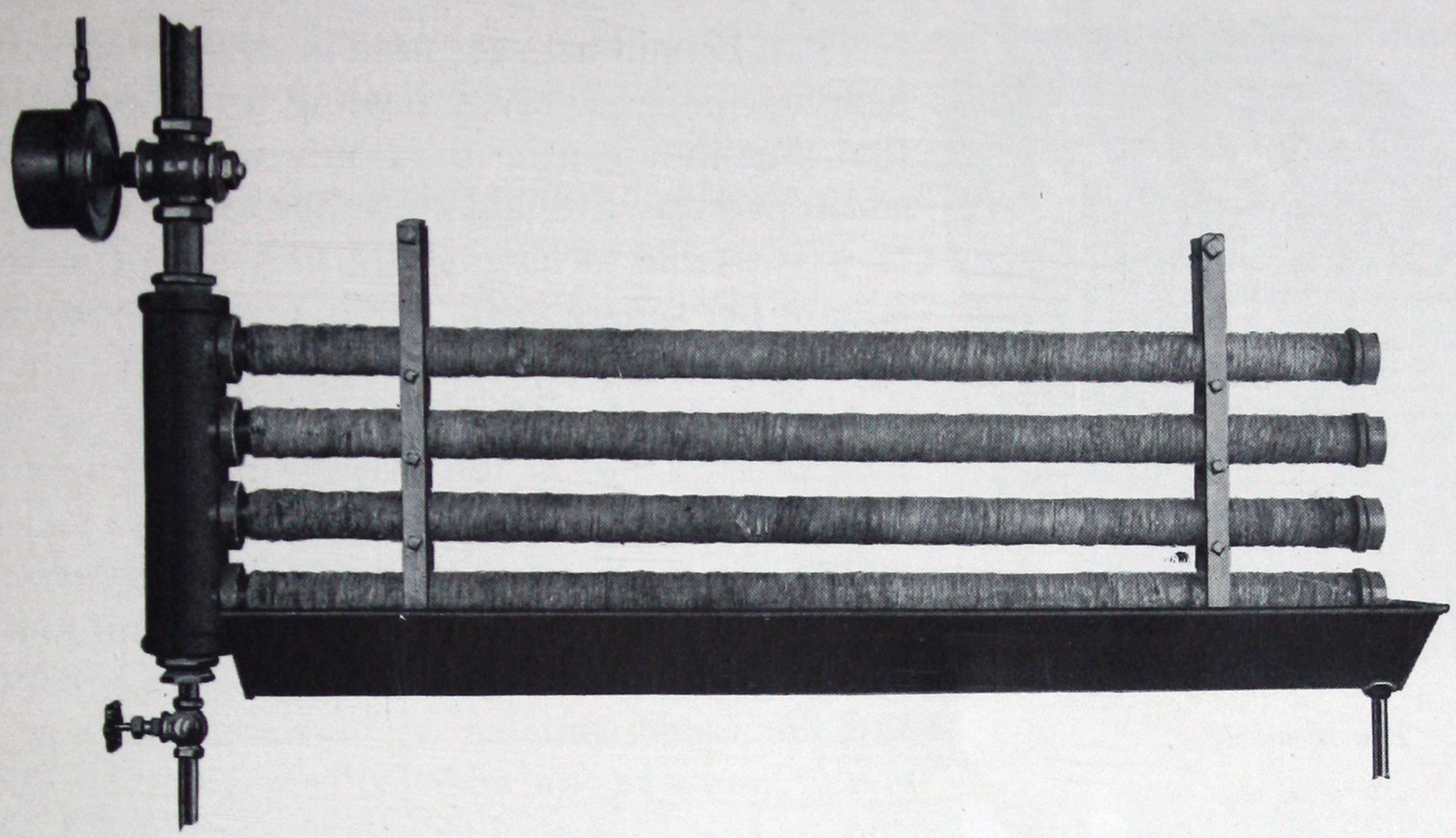
Wet Bulb Thermostat.



Whirling Hygrometer

Our Humidostats, when installed, are adjusted for operation by the employment of our Whirling Hygrometer, the depression of the wet bulb thermometer thereon and reference to a hygrometric table furnished with each instrument, indicating the per cent of moisture, or relative humidity.

Perforated Steam Pipe Humidifier



The Johnson Perforated Steam Pipe Humidifier shown by the above cut is something more than just a pipe drilled full of holes. If a cheaper device could do the work we would not spend our money making the more expensive but PRACTICAL humidifier, sometimes known as the JOHNSON GRID HUMIDIFIER.

In the first place, IT IS NOISELESS; a very important feature in schools and residences. In schools provided with fan ventilation the humidifiers must be installed in the fan chamber and not in the duct; the slightest noises are readily transmitted through the ducts to the class rooms, causing annoyance and distracting the attention of the pupils.

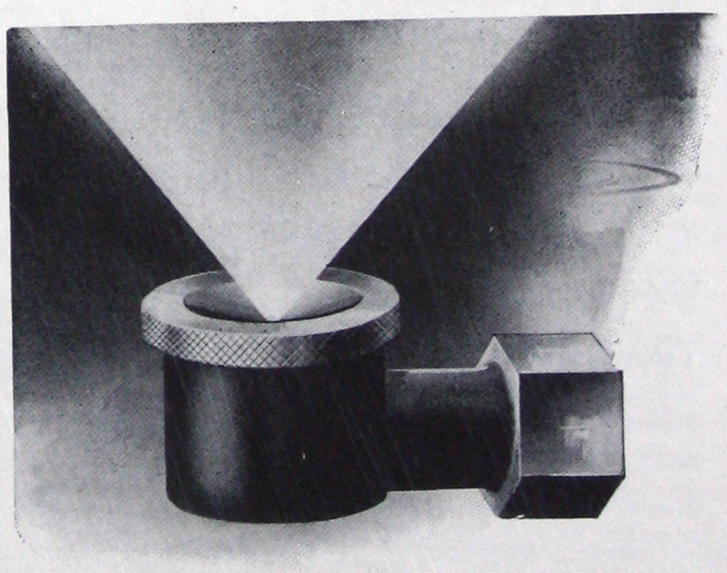
In the second place, it gives BETTER DISTRIBUTION OF MOISTURE to the air.

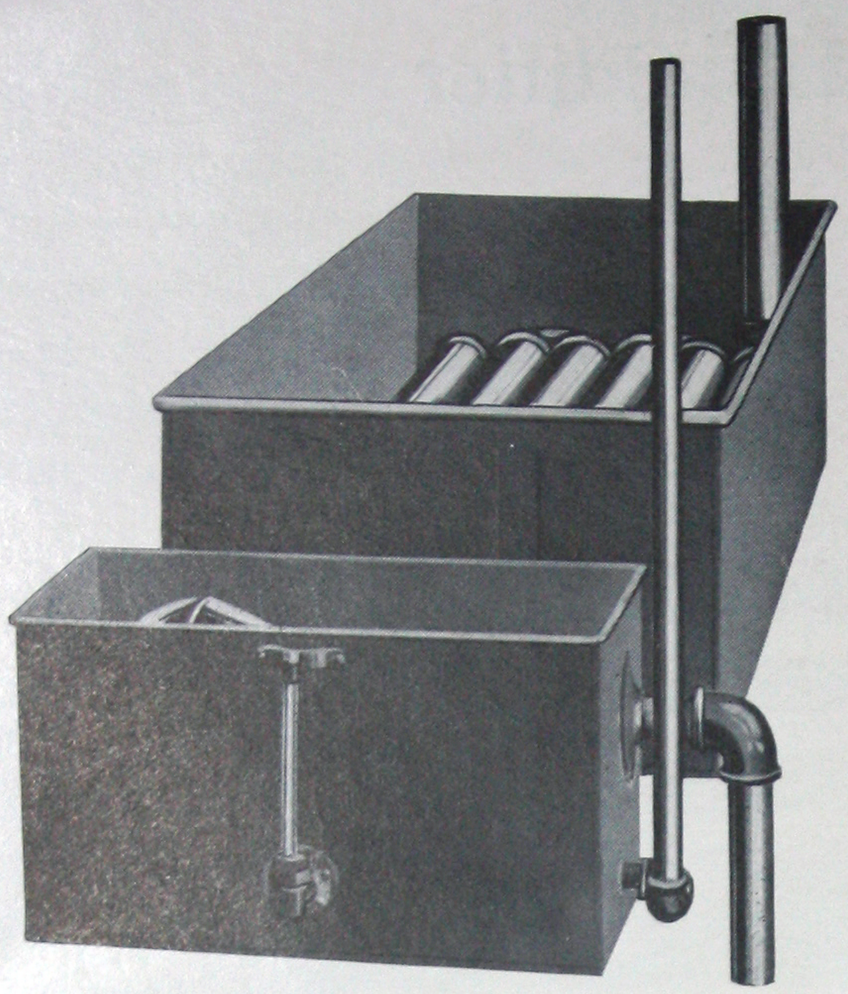
This type of humidifier should be used only where the steam is clean and free from oil, and to prevent noise the steam pressure supplied should be not more than five pounds per square inch at the humidifier. Wherever POSSIBLE, IT SHOULD BE LOCATED BETWEEN THE TEMPERING COILS AND THE FAN; THE FAN WILL ASSIST IN MIXING THE STEAM WITH THE AIR.

When controlled by our graduated-acting humidostat the steam will be delivered to the air in just the right amount to maintain the proper percentage of humidity.

Spray Heads

On fan furnace heating plants steam is not available, and we therefore use what is known as a spray head or mist nozzle. These heads are connected to the city water supply and are located in the hot air chamber.





Pan Humidifier.

Johnson Pan Humidifiers

Pan Humidifiers are used in connection with hot blast heating, indirect gravity heating or tempered air ventilation, but they can be used only where there is sufficient steam pressure available to vaporize the water in the pan. It is advisable to have steam pressure of at least twenty pounds per square inch. While we make pan humidifiers operating on lower pressure than this, they are expensive, requiring large coils and usually taking up more space than is available in the average heating plant. Where sufficient steam pressure is to be had, the pan humidifier makes the most complete and satisfactory outfit; it is NOISELESS and free from the odors very apt to be given off by the grid humidifiers when the steam pressure is high and the water contains an over-abundance of vegetable matter, and it has the added advantage that in special cases medicated water may be supplied to the pan. JOHNSON PAN HUMIDIFIERS ARE MADE OF COPPER AND SUPPLIED WITH PROPER SIZED COILS OF HEAVY BRASS TUBING, HEADERS AND RETURN ELLS. The size of coils required to supply the correct amount of moisture to the air is determined accurately by our engineering department. The correctness of our formula is confirmed by hundreds of satisfactory installations, all requiring different size humidifiers. The above illustration shows the typical Johnson Pan Humidifier connected with a copper float-box for maintaining the proper water level over the steam coils. The float-box is usually located outside the duct or fan chamber; it is connected with the pan by a large-size pipe, and it is provided with gauge glass showing height of water in the pan. (ALL JOHNSON HUMIDIFYING PANS HAVE LARGE DRAIN AND OVERFLOW CONNECTIONS, ALSO A HOSE CONNECTION FOR WASHING DOWN THE PAN.)

The appearance, method and location of the perforated pipe and the pan humidifiers are shown in the illustrations on pages 59, 60, 61 and 62, illustrating and describing the application of the Johnson System of temperature and humidity control to heating and ventilating units. The illustrations on pages 59 and 60 show the pan humidifier and the illustrations on pages 61 and 62 show the perforated pipe humidifier.

While these illustrations show the humidity controlled by humidostats located in the outlet of the fan, it could be as well controlled by a room humidostat located in one of the rooms to which the fan is delivering air and in buildings such as theatres, auditoriums and assembly halls where air is being delivered to one large room it is preferable to have the humidity controlled by a room humidostat located at the point where a certain relative humidity is desired.

Method of Producing and Controlling Humidity

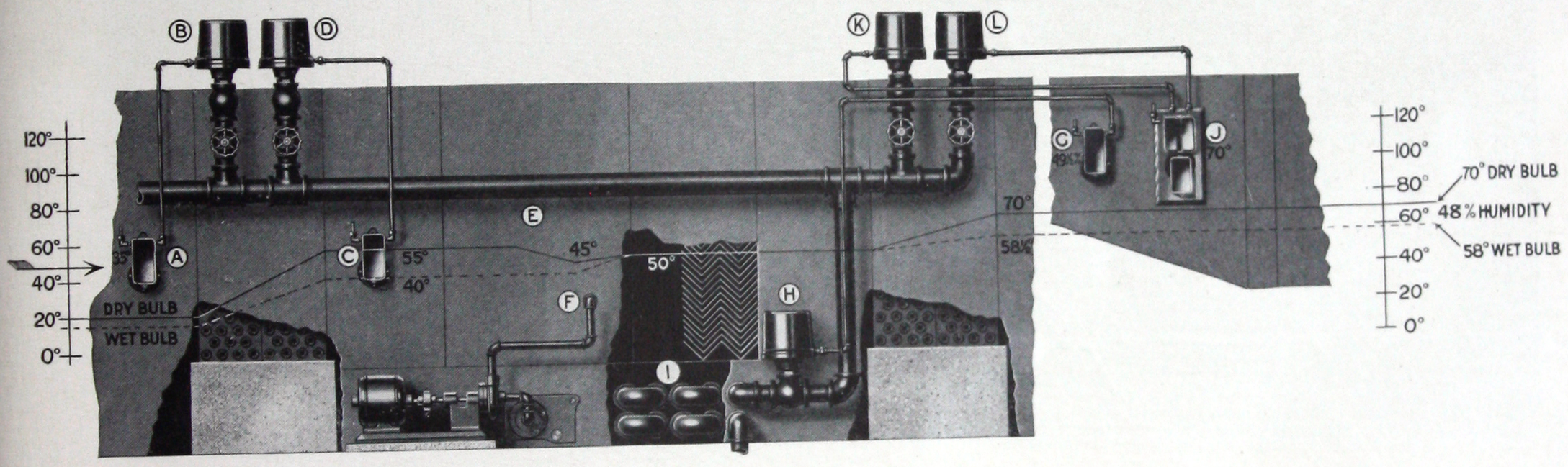
There are a great many ways of producing and controlling humidity and a great many combinations of humidostats, thermostats, valves, air washers, etc., for properly controlling the relative humidity of air for heating and ventilating purposes. These methods may be briefly summarized as follows:

Evaporation of Water—Room or duct humidostats with pan humidifiers.

Steam Humidification—Duct or room humidostats with grid humidifiers.

Absorption Humidification—Room or inserted thermostats and humidostats with spray nozzles, air washer equipment.

The first two are the Johnson methods, using humidostats with either perforated pipe or pan humidifiers and are ideal for producing and controlling humidity without air washer equipment. The illustration on page 60 shows the arrangement of the apparatus for this method in connection with the heating and ventilating plan for a theatre, auditorium or other similar building. The illustration on this page shows the Johnson method of controlling humidity either in connection with an air washer, or without, by means of a humidostat.

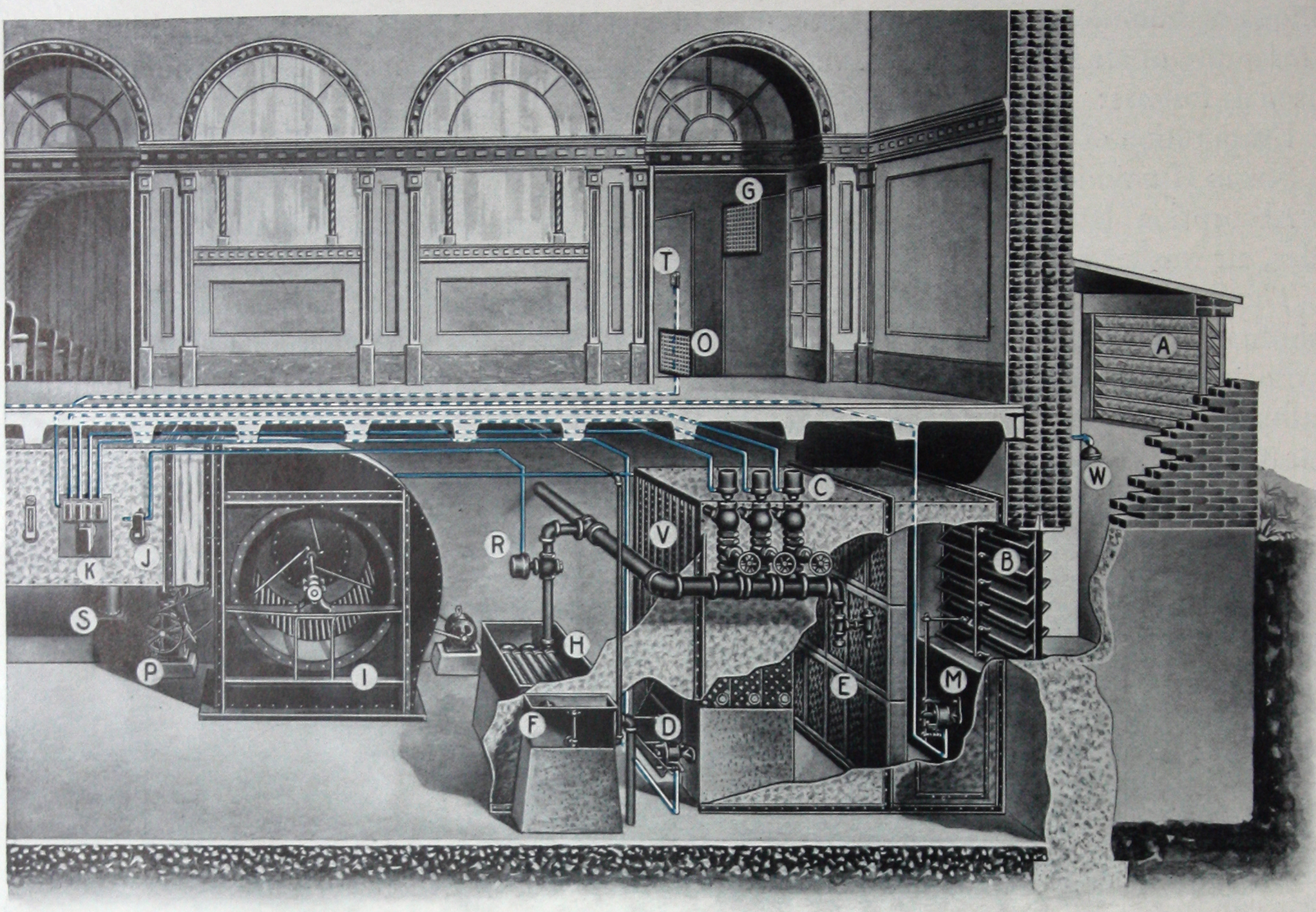


Air enters at the left through fresh air intake. Thermostat "A" controls valve "B" to supply heat to first section of tempering coils up to a temperature of 35°. Thermostat "C" controls valve "D" on second section of tempering coils and is set to close valve "D" at 55°. "E" is the spray chamber (spray not shown). "F" indicates water to supply to spray, the temperature of which is controlled by humidostat "G" set at 48% humidity, located in fan outlet (fan not shown) through valve "H" supplying steam to coils "I" in spray water tank. Thermostat "J" controls the two sections of reheater coils through valves "K" and "L" and is set at 70°. The wet and dry bulb temperature lines indicate the temperature of the air as it passes through the air washer. The final result of 70° dry bulb and 58° wet bulb or 48% humidity is the recognized ideal condition for people at rest.

The advantage of this method is that if it is not desired to use the air washer, the evaporating pan, the end of which is shown at letter "I", will produce humidity and the percentage will be controlled by the humidostat "G".

There are many other methods of controlling humidity when air washers are used. In most all of these cases the humidity is controlled by controlling the temperature of the spray water. In some cases this is done by a thermostat inserted in the water pan of the spray chamber operating on a three-way valve which emits a mixture of steam and cold water to the sprays. In other cases, it is done by a thermostat located in the saturated space of the air washer operating on valves which control the temperature of the spray water. The Johnson thermostats and valves are equally efficient with any of these methods and the results can be guaranteed.

Application of Johnson Temperature and Humidity Control With Pan Humidifier and Dry Filter



The indirect system of heating and ventilation consists of indirect radiation (V), of sufficient capacity to warm incoming air for ventilation requirements and to offset the heat loss from the Auditorium and a Johnson Pan Humidifier (H) to supply to the air sufficient water vapor to maintain healthful and comfortable conditions.

Air for ventilation is drawn through stationary weather protection louvres (A) through Johnson Fresh Air Damper (B), through Dry Air Filter (E), then through indirect radiation (V) or through Johnson By-Pass Damper (D) over Johnson Copper Pan Humidifier (H) into supply fan (I) then forced through distributing system over Johnson Four Point Multiple Compound Insertion Thermostat (K) and Johnson Inserted Humidostat (J) through distributing grills (G) into Auditorium and finally vented through vent outlet (O) through Johnson Vent Dampers (not shown) to atmosphere.

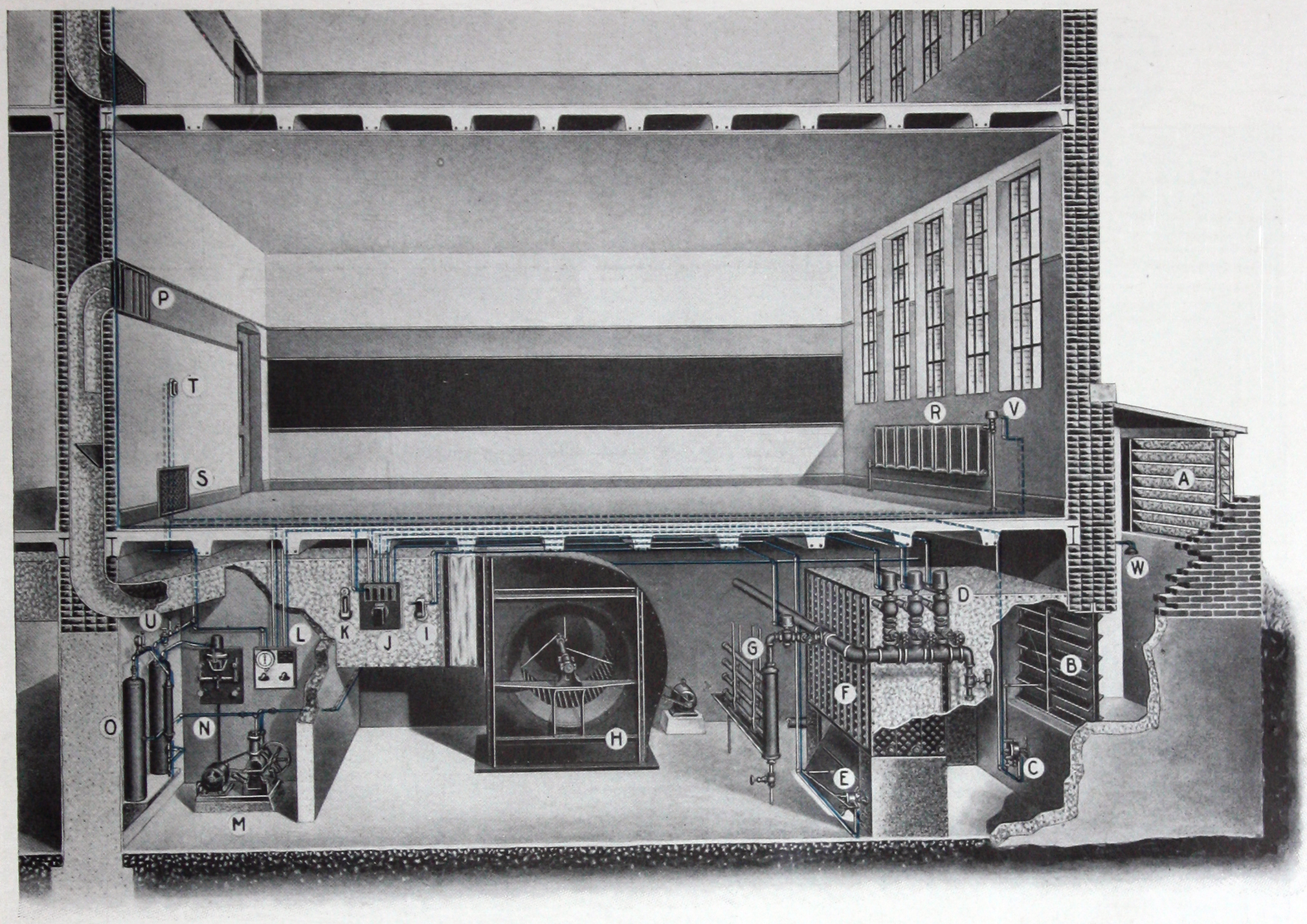
Automatic control is accomplished as follows: Johnson Belted Automatic Air Compressor (P) compresses air from Johnson Suction Strainer (W) into air storage tank (S) at a pressure of 14 to 16 pounds per square inch and distributes it through galvanized iron piping (shown by blue lines in cut) to the various pneumatic devices.

Johnson Lever Handled Switches mounted on Johnson Pneumatic Switchboard (not shown) are used to open and close at will Johnson Fresh Air Damper (B) and Johnson Vent Damper (not shown) by means of Johnson Sylphon Damper Motors (M).

Johnson Pilot Room Thermostat (T) operates to supply air to Johnson Four Point Compound Multiple Thermostat (K) only after Auditorium has reached desired temperature after which Johnson Four Point Compound Multiple Insertion Thermostat (K) operates to open or close Johnson Sylphon Coil Valves (C) or Johnson By-Pass Damper (D) to maintain desired minimum temperature of air for ventilation.

Johnson Reverse Acting Valve (R) on steam supply to evaporating coils in Johnson Pan Humidifier (H) is operated on slight change in relative humidity in duct at Johnson Inserted Humidostat (T) to maintain desired relative humidity in ventilation supply. Make up water is furnished to Pan Humidifier through automatic float-box (F) from water supply main to maintain constant level above evaporating coils in Humidifier.

Application of Johnson System of Temperature and Humidity Regulation and Damper Control to the Combination System of Heating and Ventilation



The combination system of heating and ventilation consists of direct radiators (R) generally of sufficient size to offset the heat loss from the exposed wall and glass surface, and indirect radiation (F) of sufficient capacity to warm the air for ventilation requirements.

Air for ventilation is drawn through stationary weather protection louvres (A), through JOHNSON FRESH AIR LOUVRE DAMPER (B), through indirect radiator (F), or JOHNSON BY-PASS DAMPER (E) over JOHNSON GRID HUMIDIFIER (G) into ventilating fan (H) and then forced through distribution system over JOHNSON FOUR POINT MULTIPLE COMPOUND INSERTION THERMOSTAT (J) and JOHNSON INSERTION HUMIDOSTAT (I), through distributing louvres (P) into room and finally vented through opening (S).

Automatic control of system is accomplished as follows: JOHNSON SILENT DRIVE AIR COMPRESSOR (M) controlled by JOHNSON AUTOMATIC GOVERNOR SWITCH (N) compresses air from JOHNSON SUCTION STRAINER (W) into storage tanks (O) at a pressure of 18 to 20 lbs. per square inch. The air pressure is reduced to 15 lbs. per square inch by JOHNSON PRESSURE REDUCING VALVE (U) and distributed through galvanized iron piping system (shown by blue lines on cut) to the various pneumatic devices.

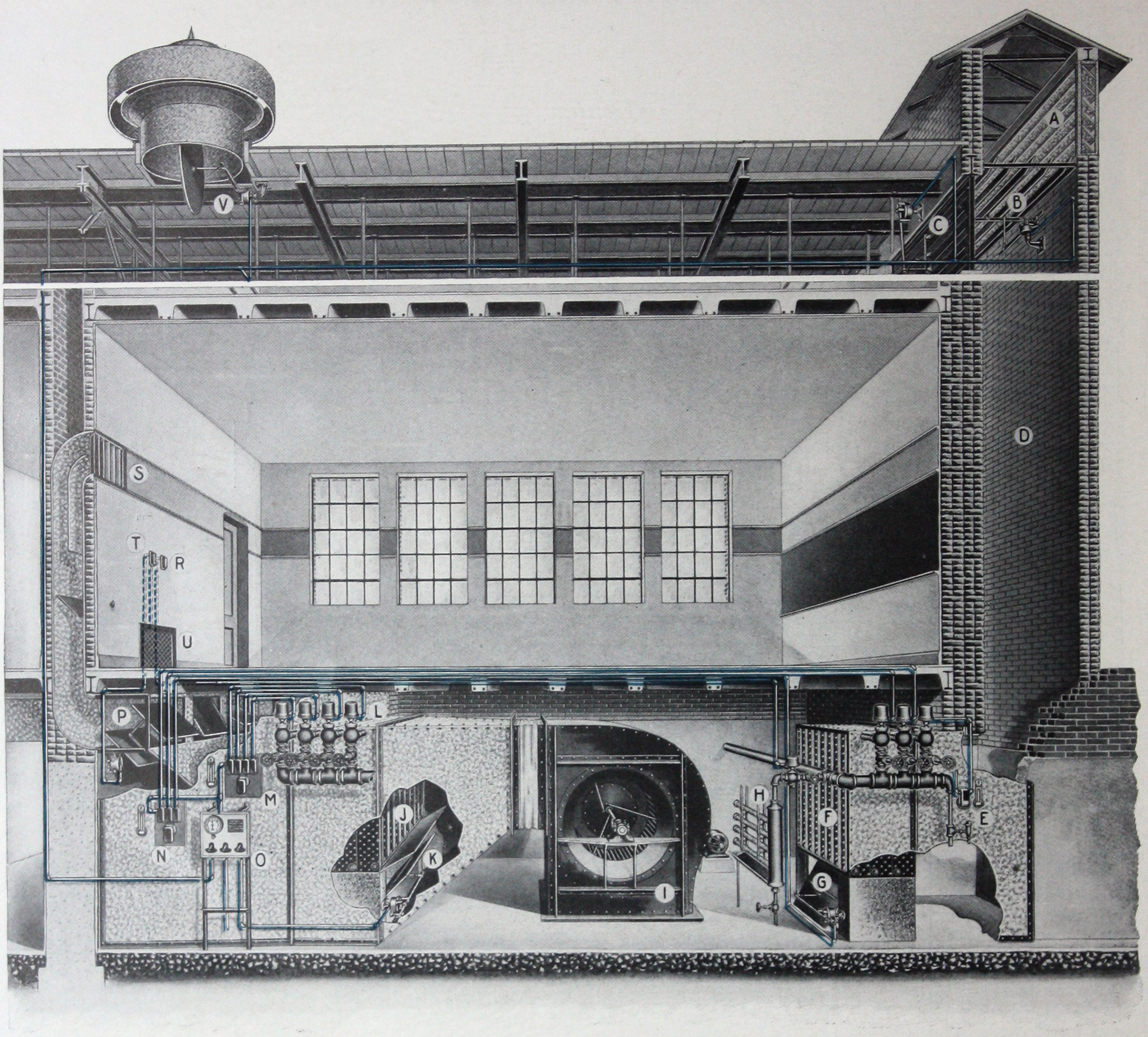
JOHNSON LEVER HANDLED SWITCHES mounted on JOHNSON PNEUMATIC SWITCHBOARD (L) are used to open and close at will JOHNSON FRESH AIR DAMPER (B) and JOHNSON VENT DAMPER (not shown) by means of JOHNSON SYLPHON DAMPER MOTORS (C).

JOHNSON SYLPHON COIL VALVES (D) and JOHNSON BY-PASS DAMPER (E) are automatically opened and closed successively by JOHNSON FOUR POINT MULTIPLE COMPOUND INSERTION THERMOSTAT (J) to maintain desired temperature of air for ventilation.

JOHNSON REVERSE SYLPHON VALVE on JOHNSON GRID HUMIDIFIER (G) is operated automatically on a slight change in relative humidity, by JOHNSON INSERTION HUMIDOSTAT (I) to maintain any desired humidity.

JOHNSON SYLPHON RADIATOR VALVE (V) is opened and closed automatically by JOHNSON ROOM THERMOSTAT (T) on a variation of temperature of one degree at thermostat to maintain desired room temperature.

Application of Johnson System of Temperature, Humidity and Damper Control to the Steam Blast System of Heating and Ventilation



The steam blast system of heating and ventilation consists of groups of indirect radiation called tempering coils (F) of sufficient capacity to warm air for ventilation to approximately room temperature, and heating coils (J) of sufficient capacity to offset all heat losses from the building.

Air for heating and ventilation is drawn through stationary weather protection louvres (A), through JOHNSON FRESH AIR DAMPER (B), through tempering coils (F) or JOHNSON BY-PASS DAMPER (G), over JOHNSON GRID HUMIDIFIER (H) into ventilating fan (I) and then forced through heating coils (J) or tempered air-pass (K) into warm and tempered air chambers, then through JOHNSON DOUBLE MIXING DAMPERS (P) into individual ducts to distributing louvres (S) and into room. Having performed both functions of heating and ventilation, the air is vented through opening (U) into attic space and then through JOHNSON ROOF VENTILATOR DAMPER at (V), or it may be recirculated through JOHNSON RETURN AIR DAMPER (C).

Automatic control of system is accomplished as follows: Compressed air is furnished by JOHNSON AUTOMATIC AIR COMPRESSOR and air storage system (not shown) through galvanized iron piping (shown by blue lines in cut) to the various pneumatic devices.

JOHNSON LEVER HANDLED SWITCHES mounted on JOHNSON PNEUMATIC SWITCHBOARD (O) are used to open and close at will the JOHNSON FRESH AIR LOUVRE DAMPER (B), the JOHNSON RETURN AIR DAMPER (C) and the JOHNSON BUTTERFLY VENT DAMPER (V), so that fresh air may be used to heat and ventilate the building, or air may be recirculated within the building for quick heating. JOHNSON LEVER HANDLED SWITCHES are also used to control air supply to tempering and reheater thermostat to obtain maximum heating effect for quick heating, and to close JOHNSON BY-PASS DAMPER (K).

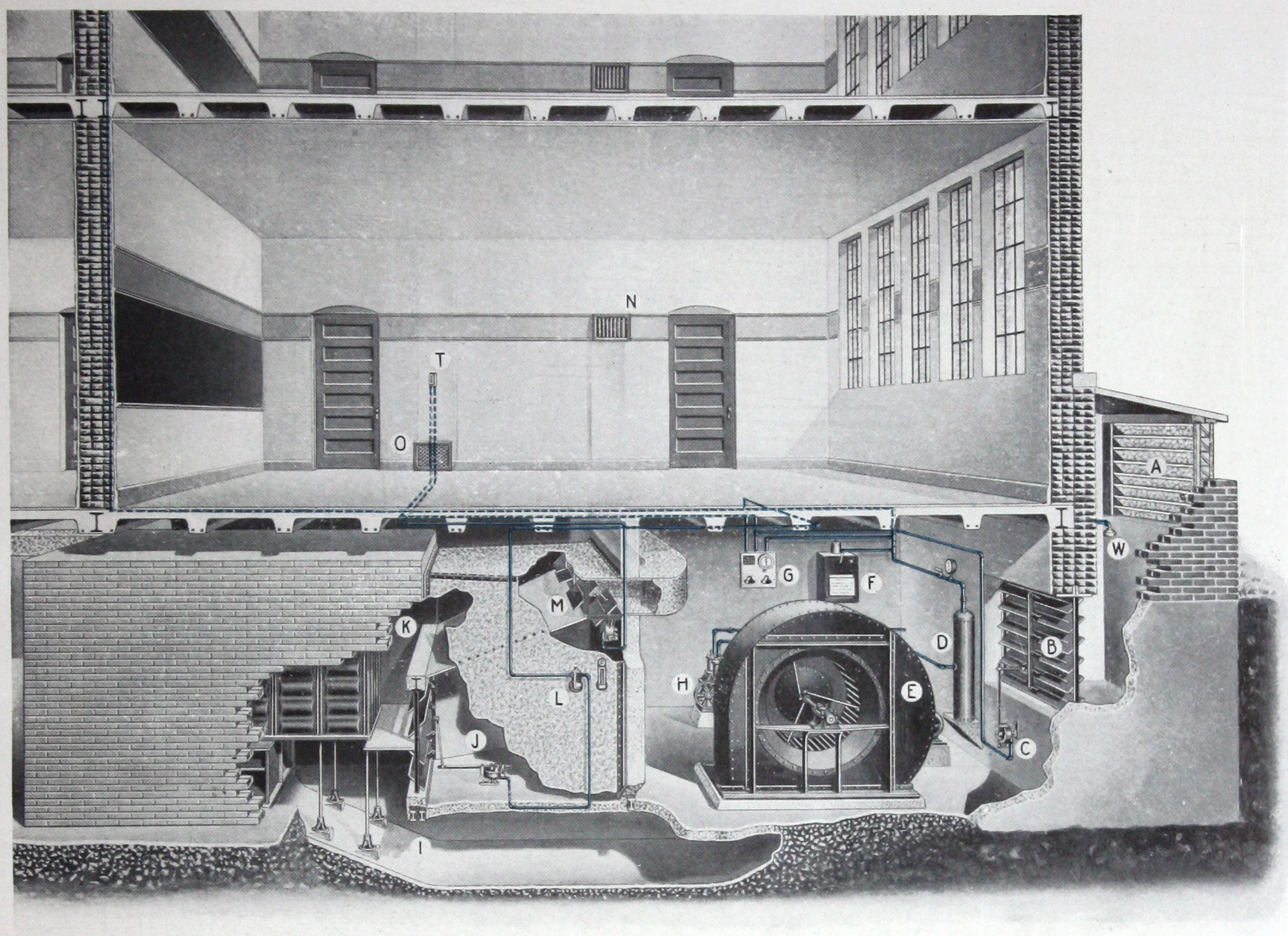
The JOHNSON SYLPHON COIL VALVE on first section of tempering heaters (F) is automatically opened from JOHNSON UNIT INSERTION THERMOSTAT (E) when temperature of incoming air drops below freezing point. The two remaining JOHNSON SYLPHON COIL VALVES and JOHNSON BY-PASS DAMPER (G) below tempering coil are automatically controlled successively by JOHNSON THREE POINT COMPOUND MULTIPLE INSERTION THERMOSTAT (N) inserted in tempering chamber to maintain tempered air at approximately room temperature.

JOHNSON SYLPHON COIL VALVES (L) are automatically controlled successively by the JOHNSON FOUR POINT MULTIPLE INSERTION THERMOSTAT (M) to maintain desired temperature in warm air chamber.

JOHNSON DOUBLE MIXING DAMPERS (P) are operated with a gradual action by JOHNSON INTERMEDIATE THERMOSTAT (T) to automatically select warm air from chamber at (M) or tempered air from chamber at (N) or a mixture of both, to maintain the desired room temperature.

JOHNSON REVERSE SYLPHON VALVE on JOHNSON GRID HUMIDIFIER (H) is operated automatically on a slight change in humidity by JOHNSON ROOM HUMIDOSTAT (R) to maintain desired relative humidity.

Application of Johnson System of Temperature and Damper Control to Warm Air Furnace Blast System of Heating and Ventilation



The warm air furnace blast system of heating and ventilation consists of direct fired warm air furnaces of sufficient capacity to heat the incoming air to a temperature sufficient to offset all heat losses from the building, and to serve the ventilation requirements.

Air for heating and ventilation is drawn through stationary weather protection louvres (A), through JOHNSON FRESH AIR LOUVRE DAMPER (B) into ventilating fan (E) and forced through tunnel (I), through warm air heaters in chamber (K), or by-passed through tempering damper into tempered air chamber (J), then through JOHNSON DOUBLE MIXING DAMPERS (M) into individual ducts and through distributing louvres (N) into room. Having performed both functions of heating and ventilation, the air is finally vented through opening (O).

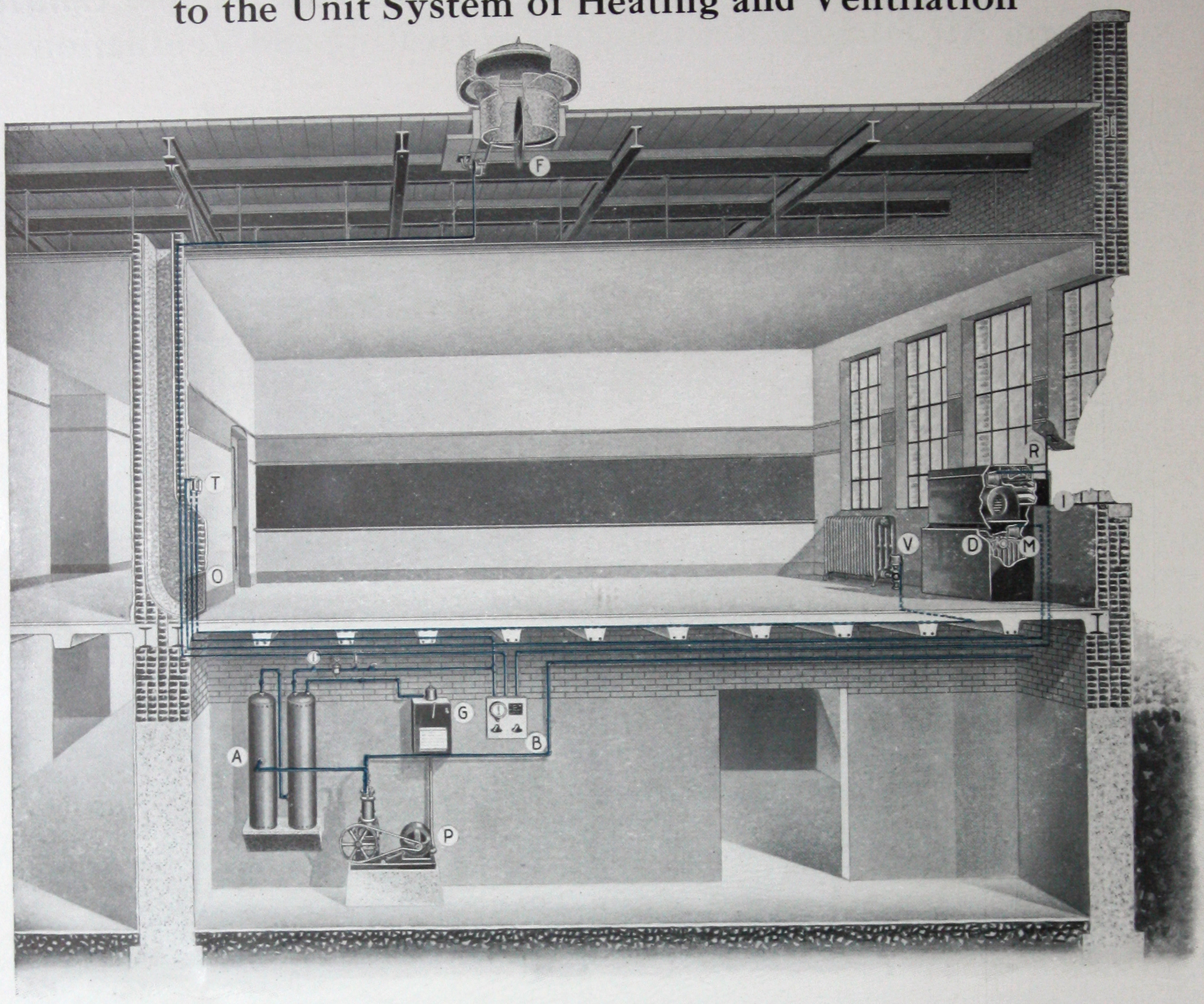
Automatic control of system is accomplished as follows: JOHNSON SILENT DRIVE AIR COMPRESSOR (H) controlled by JOHNSON AUTOMATIC GOVERNOR (F) compresses air from JOHNSON SUCTION STRAINER (W) into storage tank (D) at a pressure of 15 lbs. per square inch and then distributes it through galvanized iron piping system (shown by blue lines in cut) to the various pneumatic devices.

JOHNSON LEVER HANDLED SWITCHES mounted on JOHNSON PNEUMATIC SWITCHBOARD (G) are used to open and close at will JOHNSON FRESH AIR DAMPER (B) and JOHNSON VENT DAMPERS (not shown) by JOHNSON SYLPHON DAMPER MOTORS (C).

Tempered air chamber (J) is automatically maintained at approximately room temperature by JOHNSON DOUBLE TEMPERING DAMPER at (J) operated gradually by JOHNSON UNIT INSERTION THERMOSTAT (L) to admit a mixture of cold air from fan (E) and warm air from chamber (K).

JOHNSON DOUBLE MIXING DAMPERS (M) are operated with a graduated action by JOHNSON INTERMEDIATE ROOM THERMOSTATS (T) to automatically select warm air from chamber (K) or tempered air from chamber (J), or a mixture of both, to maintain the desired room temperature.

Application of Johnson System of Temperature and Damper Control to the Unit System of Heating and Ventilation



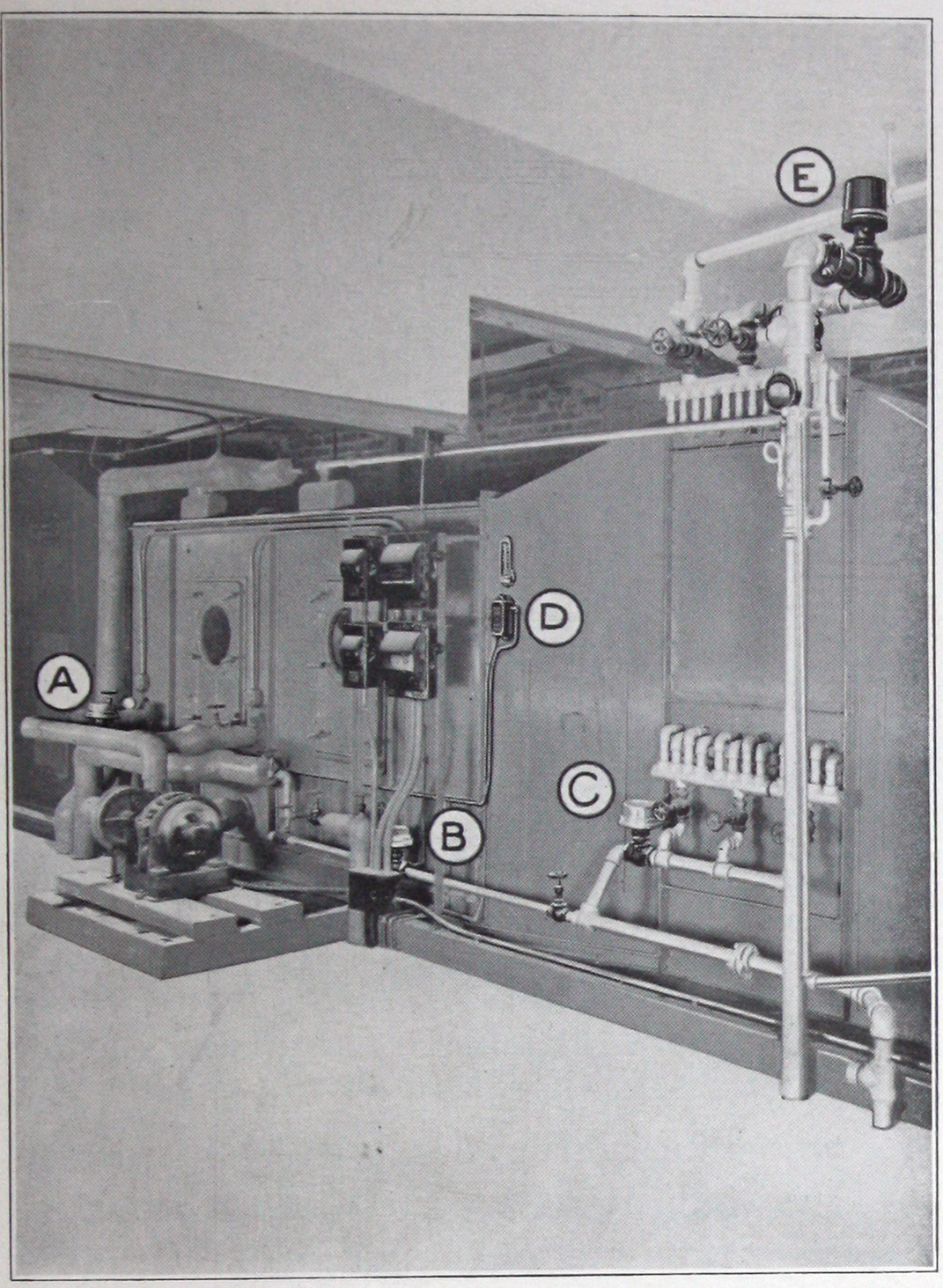
The unit system of heating and ventilation consists of direct radiators (V) of capacity to partially offset the heat loss from the exposed wall and glass surface and indirect radiator (M) in the unit ventilating machine of sufficient capacity to furnish additional heat necessary and to serve the ventilation requirements. The air for heating and ventilating is drawn through the inlet (I) and then passes either through the indirect radiator in the unit or around it or partly through it and partly around it, as determined by the position of the mixing damper (D) which is controlled by the thermostat (T). The heated, tempered, or mixed air passes into the room and is finally vented through opening (O) and roof ventilator (F).

JOHNSON AIR COMPRESSOR (P) controlled by JOHNSON AUTOMATIC GOVERNOR SWITCH (G) compresses air drawn from outdoors, through JOHNSON SUCTION STRAINER (not shown) into storage tanks (A) at a pressure of 15 lbs. per square inch and then distributes it through galvanized iron piping system (shown by blue lines in cut) to the various pneumatic devices.

JOHNSON LEVER HANDLED SWITCHES mounted on JOHNSON PNEUMATIC SWITCHBOARD (B) are used to open and close at will fresh air damper at (I), return damper at (R), and JOHNSON BUTTERFLY DAMPER (F). When classrooms are occupied, fresh air damper at (I) and JOHNSON BUTTERFLY DAMPER (F) are opened and return air damper at (R) is closed, so that the unit is taking outside air. When the room is not occupied, the position of the dampers may be reversed, and the unit is recirculating the air in the room. This is especially advantageous for quick heating in the morning.

When the room is below the desired temperature, JOHNSON SYLPHON RADIATOR VALVE (V) is open, mixing damper (D) in the unit machine is open, and the air is forced through the indirect radiator before entering the room. As the temperature in the room approaches the desired point, the JOHNSON SYLPHON RADIATOR VALVE (V) is closed with a positive action by the JOHNSON COMPOUND ROOM THERMOSTAT (T), and the mixing damper (D) is closed with a gradual action to by-pass the air around the indirect radiator, thus holding room at desired temperature.

Industrial Temperature Control



Regulated Air Conditioning.

The control of temperature and humidity plays an important part in many industries; temperature and humidity are vital factors in the production of almost everything. Steel. leather, lumber, clothing and foods are all subject to the action of heat, and frequently of moisture in their manufacture, and many are dependent for their quality and useful condition upon the maintenance of an even temperature and humidity. The thermostats, humidostats, valves, dampers and other apparatus of the Johnson System are used extensively in these manufacturing processes and are applied in a great variety of ways. In many cases the regulating apparatus functions to control the atmospheric conditions required to produce an article of the best quality. Bakeries, Tobacco Plants, Cotton and Silk Mills, Furniture Factories, Tanneries, Printing Shops and Rubber Tire Factories are some of the more common industrial buildings in which heating, ventilating and humidity producing apparatus are profitably and satisfactorily controlled for the making of a superior article.

Illustration on this page is the air conditioning equipment for the Dough and Mixing Room of the Atlas Bakery, Milwaukee.

In this installation Insertion Type Thermostat "D" controls Sylphon Valve "B" on steam supply to pre-heater in air washer spray chamber for winter operation, and Sylphon Brine Valve "A" on refrigeration line to the same coil for summer operation. Winter or summer operation is handled by a Three-Way Pneumatic Switch; no change in adjustment of the Thermostat being necessary. Valves "A" and "B" cannot possibly operate against each other. Sylphon Valves "E" and "C" on the supply and return connections to reheating coils and by-pass damper beneath the coils—which is not visible in the cut—are controlled by a Room Type Johnson Thermostat in the dough room. With this unusually simple arrangement uniform conditions of temperature and humidity are maintained in this room throughout the entire year.

Tobacco: Tobacco curing is another industrial process where air conditioning as controlled by thermostats and humidostats is a valuable part of the process. In one factory in Philadelphia, readings were taken hourly from eight in the morning until five o'clock at night, and during the period of observation the humidity varied from 68% to 71% with the practically constant temperature of 70 degrees. As the specifications called for a constant temperature of 70 degrees and a constant humidity of 70%, this record would appear extremely close and satisfactory.

Lumber: Lumber is seasoned in less time and in a better condition by being subject to a blast of air of the proper temperature and humidity for given periods of time. The Johnson thermostats and humidostats in connection with air conditioning units correctly regulate these conditions.

Silk and Cotton: In spinning and weaving silk and cotton it is quite necessary that the temperature and humidity be kept at certain points, as otherwise the threads will become too slack and tangle. We are controlling these conditions in many mills throughout the United States with wonderful results.

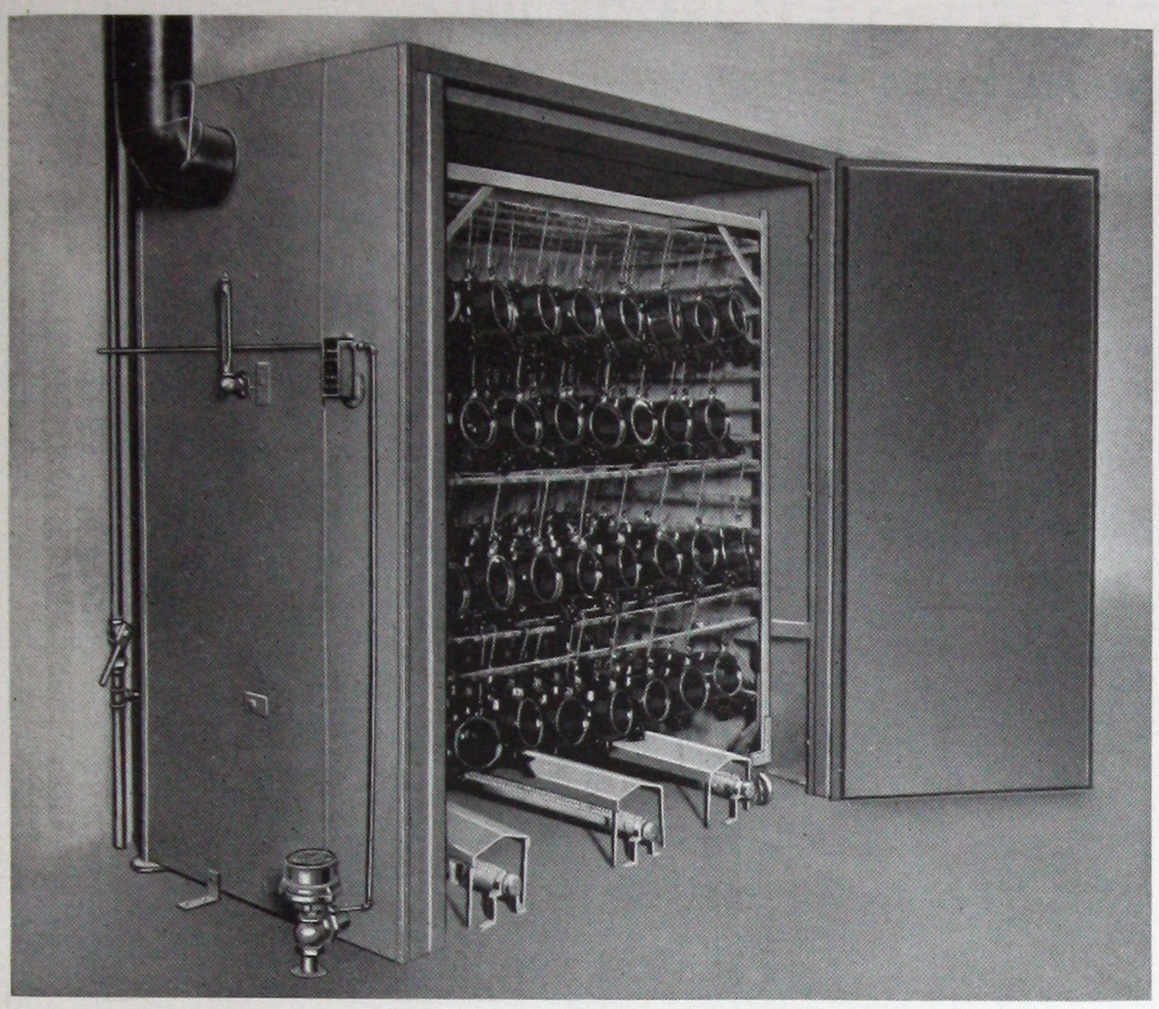
Furniture, Pianos, Victrolas: In most all departments of woodworking and furniture factories, the regulation of temperature and humidity is of vital importance. If the wood is too dry, it will later absorb moisture and possibly crack, or if it is too moist it will later dry and form a loose joint. In the varnishing and finishing room, the varnish will crack and chip unless applied and seasoned under correct air conditions. The Johnson thermostats and humidostats have proven conclusively their high degree of efficiency in this respect in many high class furniture and finishing factories.

Printing: The same considerations apply in the press rooms of printing shops. When the air conditions are not absolutely correct, the paper breaks, crackles, and sticks to the rollers. This causes a great loss of time and paper. It has been demonstrated in many press rooms that a constant degree of temperature with the proper humidity as produced by thermostats and humidostats will prevent this very serious loss of time and material. The making of waxed, glazed and gummed paper is also dependent on the use of thermostats and humidostats controlling the temperature of the air blasts and the humidity of the air applied to the product as it passes through a machine.

Leather: Temperature regulation is used extensively in the production of all kinds of leather. The temperature of the water and the atmospheric conditions of the drying tunnels through which the hides pass during the process of tanning must be closely regulated to produce the very best results. In the manufacture of patent and enameled leathers, a controlled temperature and humid condition is necessary to prevent case hardening the coating and the drying up of the leather.

The above are a few only of the many articles that are subject to air conditioning, the process and manufacture of which could be expedited and the quality of which could be improved by the application of temperature regulation and humidity control in conjunction with air conditioning apparatus.

Oven and Kiln Regulations



Gas Heated Japanning Oven.

Many articles of common usage are finished in an oven or in a kiln and are subjected in them to certain degrees of heat. The illustration is of a japanning oven in which the heat is produced by gas burners. The installed thermostat controls the sylphon valve, turning the gas on and off at a variation of one degree above or below the point desired and in that way produces a hard baked finish that will not crack or peel off and avoids the danger of having the oven too hot, which might burn the finish, or not having it hot enough, which would prevent the finish from getting hard.

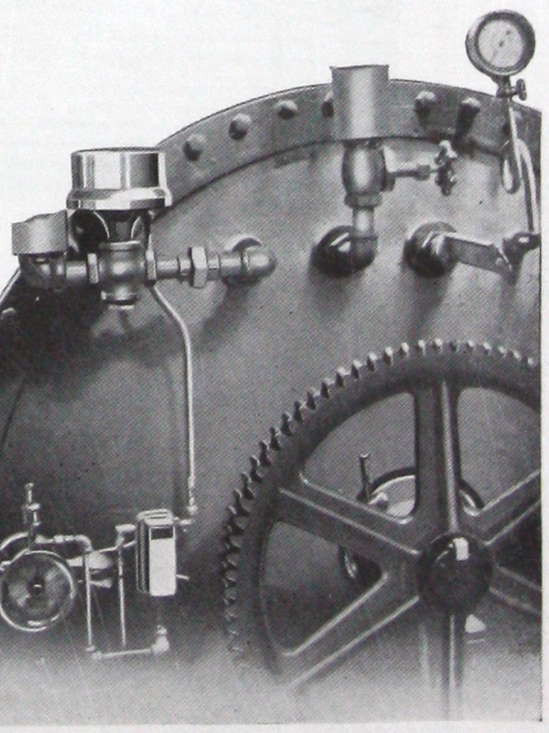
There are many different kinds of ovens and kilns using many different kinds of heat. Some are provided with electric heat, some with steam heat, and others with hot air, but all of them can be effectively and profitably controlled by Johnson thermostats and sylphon valves.

The sand cores used in making castings are dried in ovens similar to the one illustrated above and the cores are found to be of a much better quality when dried under conditions of temperature control.

The making and finishing of porcelain insulators is another process of similar nature.

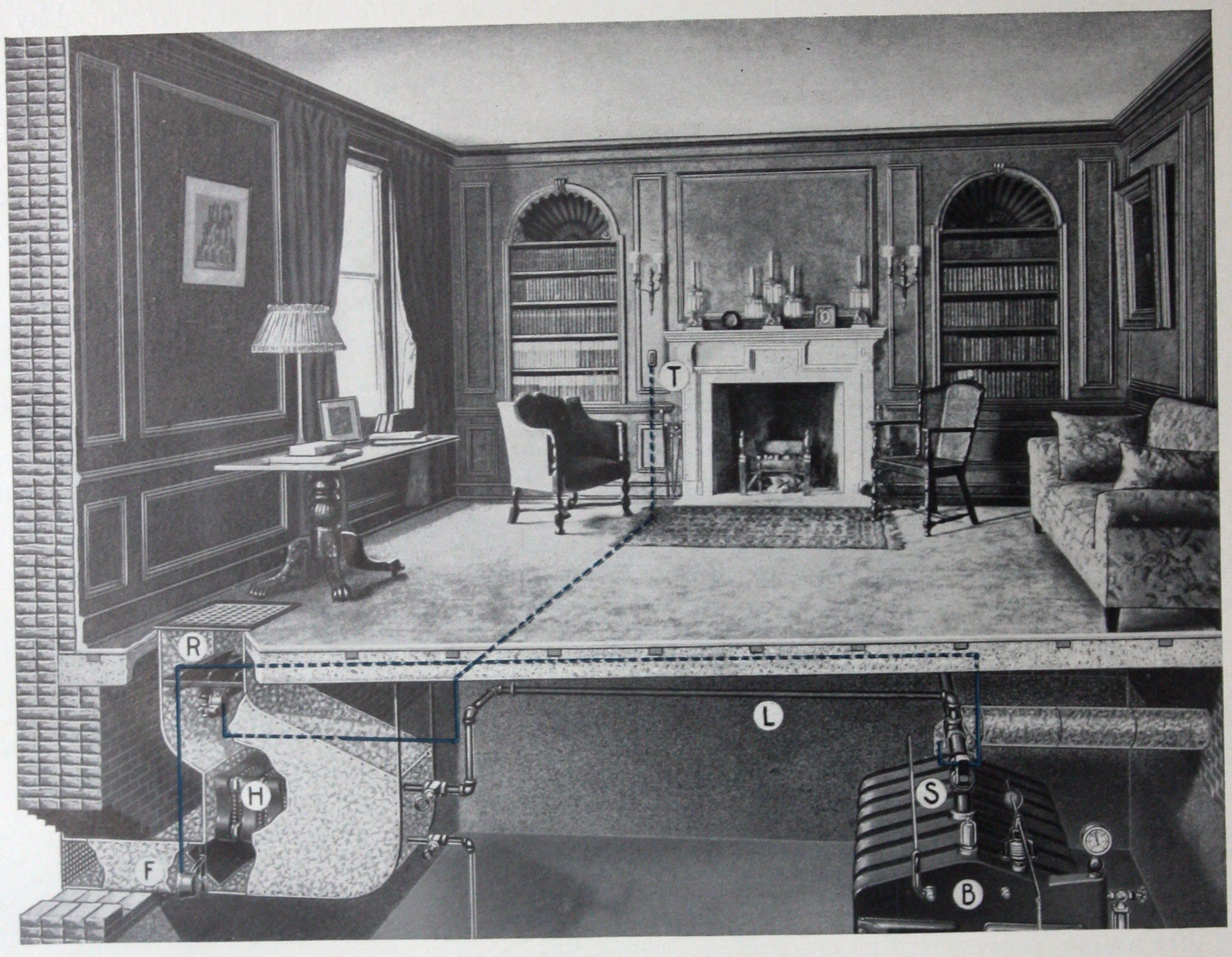
Heat Control on Machines

For some processes the controlling apparatus is attached directly to machines, such as cookers, coolers, bleachers, chocolate coaters, heat treating furnaces, fleece dryers, core drying ovens, japanning ovens. The illustration is that of an Anderson & Barngrover vegetable cooker. The diaphragm valve is controlled by the calibrated thermostat shown at the lower left side, and is opened and closed by the thermostat according to the temperature of the inside of the cooker, and as the vegetable cans pass through this cooker at the rate of several hundred per minute and are allowed a certain number of minutes for the passage, it is absolutely necessary that the temperature, while machine is in operation, remains at a constant point.



Thermostat and Valve on Anderson & Barngrover Retort for cooking cans of vegetables.

Application of Johnson System of Temperature Control to Indirect Gravity System of Heating and Ventilation in Residence



The indirect gravity system of ventilation and heating consists of a bank of indirect radiation at (H) of sufficient capacity to heat all air required for ventilation purposes and to offset heat losses through wall and window exposure. Air for ventilation and heating is drawn from register from outside through duct (F) and JOHNSON FRESH AIR DAMPER up through radiator (H) then through JOHNSON REGISTER DAMPER (R) into room and finally vented through fireplace.

Automatic control of the system is accomplished as follows: Compressed air is furnished by JOHNSON AUTOMATIC AIR COMPRESSOR and air storage system (not shown) through galvanized iron piping system (shown by blue lines in cut) to the various pneumatic devices.

JOHNSON FRESH AIR DAMPER at (F) is automatically opened by JOHNSON UNIT THERMOSTAT (S) and JOHNSON SYLPHON DIAPHRAGM ATTACHMENT when temperature of steam and water reaches safe operating point.

JOHNSON LOUVRE REGISTER DAMPER (R) is automatically operated with a gradual action from JOHNSON INTERMEDIATE ROOM THERMOSTAT (T) to close when room reaches desired temperature.

The Johnson System in the Home

It has been the business of the Johnson Service Company for years to supply an element of comfort for the best homes in this country. The large number of handsome residences in which our system of temperature regulation has been installed, and our constantly increasing business in this special field, testify to the efficiency of our apparatus, and the appreciation of its worth by discriminating home owners. Our clients include representative people throughout the country.

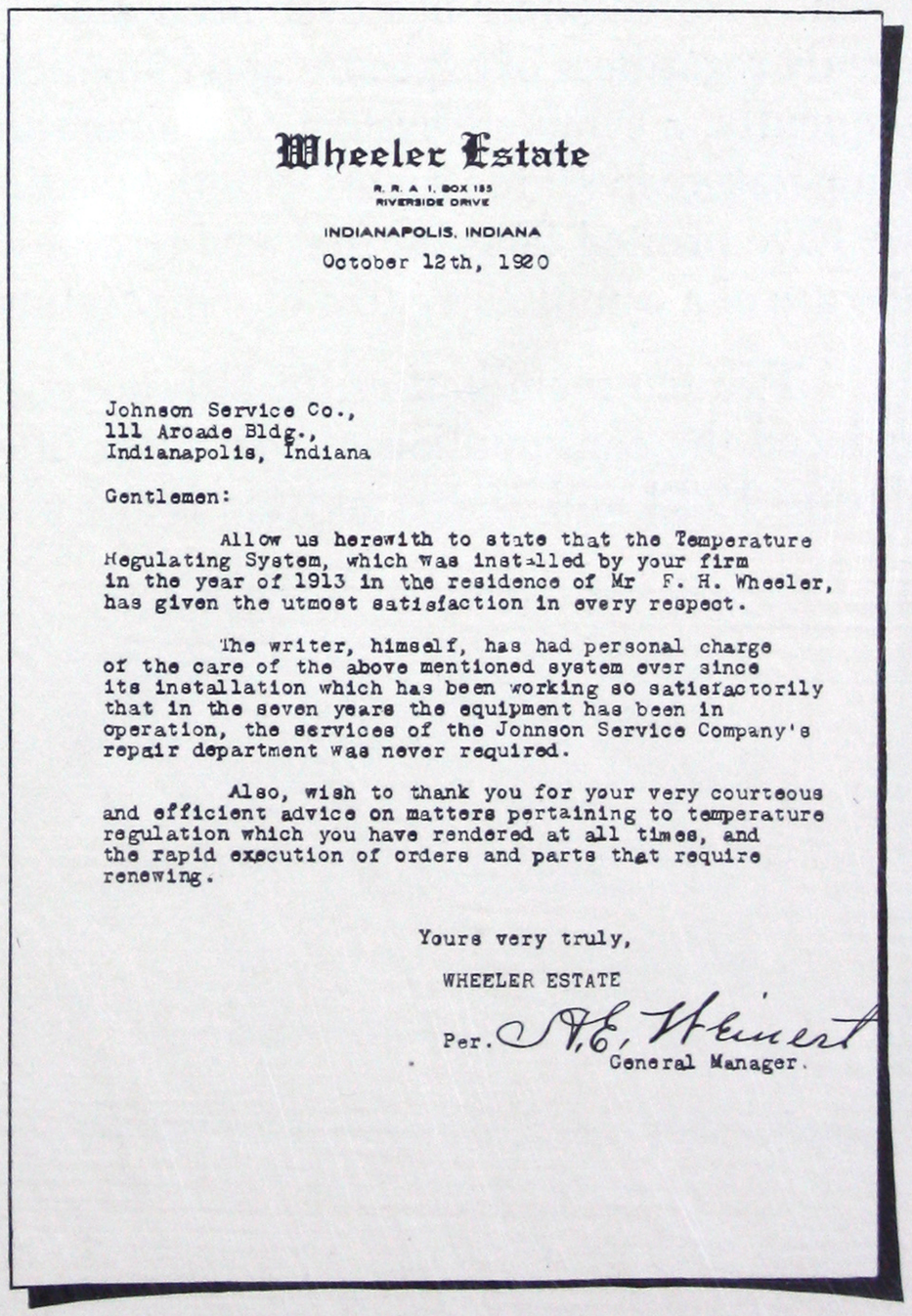
In the erection of a fine residence there is probably nothing that gives the owner more thought and has so much bearing upon the comfort and health of the family as the question of how his home shall be heated and the temperature regulated, and because of its vital importance architects and engineers are giving special attention to this problem.

Our external winter temperatures vary from zero to 50 or 60 degrees or higher. The heating plant, therefore, must be of sufficient capacity to warm the various rooms of the house to a temperature of 70 degrees with the external temperature at zero, and in some sections below; and in order to avoid the discomfort of overheating in mild weather, it should be automatically regulated. The old-fashioned method of closing heat sources by hand is not in keeping with improved methods of heating. Uniform temperatures should be maintained in the various rooms without regard to exposure or external temperature, and it is impossible to accomplish this without controlling the heat sources of the various rooms individually and automatically. If we depend upon the hand control to regulate the heating plant we are sure to have overheated or underheated houses; conditions which are so dangerous to health. It is impossible to obtain satisfactory temperatures, especially in large residences, without automatic temperature regulation. Overheating will result most of the time, because, as stated, the heating plant is always of greater capacity than necessary for average weather conditions.

Overheating means lost energy—money wasted. The heating plant should be so regulated that it will consume no more fuel than is necessary to keep the temperature of the various apartments at the degree desired.

The Johnson System of Heat Regulation is designed and applied so that it will do just this and do it automatically and successfully. The fuel saved by preventing overheating is your interest on the cost. The experience of most of our customers has been a saving of from 25 to 35 per cent. in the cost of operating the heating plant.

A most important consideration and one generally overlooked is the effect of high temperature on the woodwork, furniture and pictures, which are usually of great value. Shrinkage, warping and cracking of woodwork in new residences is caused



Wheeler Estate

R. R. A. 1, BOX 183
RIVERSIDE DRIVE

INDIANAPOLIS, INDIANA

October 12th, 1920

Johnson Service Co.,
111 Arcade Bldg.,
Indianapolis, Indiana

Gentlemen:

Allow us herewith to state that the Temperature Regulating System, which was installed by your firm in the year of 1913 in the residence of Mr F. H. Wheeler, has given the utmost satisfaction in every respect.

The writer, himself, has had personal charge of the care of the above mentioned system ever since its installation which has been working so satisfactorily that in the seven years the equipment has been in operation, the services of the Jonnson Service Company's repair department was never required.

Also, wish to thank you for your very courteous and efficient advice on matters pertaining to temperature regulation which you have rendered at all times, and the rapid execution of orders and parts that require renewing.

Yours very truly,

WHEELER ESTATE

Per. N. E. Wheeler
General Manager.

by the lack of humidity due to too much heat, and it is therefore extremely important that a normal temperature, with a correspondingly greater humidity, be maintained.

One of our leading architects of this country, who has used the Johnson System of Temperature Regulation exclusively, has stated that if there were no other advantages to be gained by the use of a temperature regulation system, he would advise its installation on account of the preservation of the floors and woodwork of a building.

This company does not advocate the use of only a single thermostat to control the temperature of an entire building. Many regulators are on the market which consist of one thermostat located in a particular room, connected to a motor, operating the drafts on the boiler or furnace. These regulators are very popular for small houses. They are excellent devices; but it is a field in which the Johnson Service Company does not enter for this reason: it is our business to produce actual temperature regulation as described on the preceding pages. We do not believe that it is possible to regulate the temperature of all the rooms in any building with a thermostat located in only one room. It is only partial regulation and will not produce the economy which can be gained only by controlling the temperature of the heat sources in each and every room. No engineer has ever been able to design a heating plant that will heat perfectly and evenly regardless of exposure and climatic conditions, at all times and under all conditions. Consequently, a complete system of temperature regulation is the only method of producing a proper temperature in all the rooms with the maximum economy in the consumption of fuel. In this book we have printed facts on fuel saving and we have further evidence that the economy effected by the use of a complete system of temperature regulation is anywhere from fifteen to fifty per cent.

Two ten-room houses, in Milwaukee, among the many equipped with the JOHNSON SYSTEM, reduced the consumption of coal from fifteen tons in the season of 1921 and 1922 to ten tons during 1922 and 1923, and the latter winter was the longer and colder.

The Johnson System in Schools and Colleges

The installation of THE JOHNSON SYSTEM OF TEMPERATURE REGULATION in schools and universities, both public and private, has become practically universal. In every state in the Union there are schools and university buildings equipped with the JOHNSON SYSTEM.

The Johnson System is a positive necessity in schools from the standpoint of healthful conditions and comfort of the teachers and pupils. The teacher is relieved of the distraction and annoyance of attending to the temperature of the room and can give undivided attention to the classes. It is a fact that headaches, colds and such ills are less prevalent in schools regulated by the Johnson System than in those not so equipped. In addition to the above the saving in fuel in a regulated school is an item not to be overlooked. The charts on page 7 and the letter reproduced on this page speak for themselves.

Boards of Education, committees and commissions governing groups of schools, in our large cities, townships and counties, readily specify THE JOHNSON SYSTEM for all the buildings under their jurisdiction following the demonstration of first JOHNSON installation.

The JOHNSON SYSTEM OF TEMPERATURE REGULATION is ideally fitted for schools because JOHNSON thermostats are designed and constructed so that students cannot tamper with the mechanism to destroy the regulation. The JOHNSON SYSTEM functions faithfully as stipulated by the thermostat, and cannot be changed except by the engineer or other person in charge of the building. Also, JOHNSON *Thermostats* and *Diaphragm Valves have diaphragms of Metal,* which will not *wear out,* deteriorate with age or require repairs due to deterioration of materials. These are the prominent features that are exclusive with THE JOHNSON SYSTEM, and constitute temperature regulation and fuel control that remains reliable always.

The Rochester Public Schools

Rochester, Minnesota

WINFRED G BOLCOM SUPERINTENDENT

October 17th
1 9 2 3

Mr. C. G. Burritt,
Manager Minneapolis Office, Johnson Service Co.,
Minneapolis, Minn.

Dear Mr. Burritte

I am sending you this letter concerning our experience with Johnson Service Heat Control. We have installed in our High School Johnson Service Control since 1917, and later in 1919 we installed same in the Lincoln and Holmes schools and in 1923 in our Northrop building and expect to install the control in our Hawthorne and Edison buildings in 1924 when all of our school system will be equipped with strictly Johnson service heat control of which we shall be proud, to say the least. I do not hesitate to recommend the service to anyone who should wish to secure any information concerning it and our six buildings speak for themselves, nor cannot express in words the comfort that can be derived by installing this Johnson Service heat control and I have evidence to back all statements I will make in this report, for instance one of our principals at the New Holmes building tells me that she has taught school in the Holmes district for twenty years and at no time has she had her school room so comfortable as it has been for the past two years since we have installed the service, and that is the main reason why our school board is installing the Johnson Service heat control in our entire school system.

A few figures may be in order on coal saved by heat control. At our Northrop school we estimated the coal saved at 45 tons at price of $9.25 a ton, total amount $416.25 times 3 years $1248.75, would about pay for heat control on a grade school and every year after that it would result in a net saving of $416.25. I therefore take great pleasure in recommending Johnson Service heat control and I also wish to say that for every letter on your equipment, where you have it stamped "Johnson Service" that is "enough said". Service is your motto, well lived up to.

If at any time your company should wish to make an inspection concerning heat control with a prospective customer, I will be only to glad to take you around.

Sincerely yours, Otto Fitzke

Engineer Rochester Public Schools.

F D

The Johnson System in the Office and Bank Building, Business Block, Club, Factory, Etc.

Figures compiled from various sources, under all conditions, in every part of the United States, show fuel savings of from 15 to 35 per cent with Johnson Automatic Temperature Regulation. In office buildings, banks, business blocks, etc., economy is a vital item; the total amount of radiation is large and the fuel tonnage is enormous, and where heat is usually purchased on meter reading basis, an appreciable amount in dollars and cents is saved each year. THE JOHNSON SYSTEM OF TEMPERATURE REGULATION controls the temperature of each room in accordance with the outside temperature—furnishing the correct amount of heat for the temperature required; likewise, it controls the heat source, keeping down the fuel consumption and never allowing it to go beyond what is required.

Excess heat, heat waste and consequent fuel extravagance in this class of buildings results from errors of commission and omission on the part of occupants of each room or department of the building. The tenants, clerical employees or attendants do not close off radiators and the extra heat is wasted. A room becomes too warm and the occupant opens the windows; the temperature of the room is lowered, but the steam continues to condense in the radiators. On a mild day, for another example, the radiators are turned off and the building tenants, employees and other occupants leave them that way at the close of business. During the night a cold wave suddenly comes; pipes freeze, or to prevent that it is necessary to send a force through the building to turn on the radiators. Or the reverse occurs: on a severely cold day occupants of the building leave with the radiators turned on full; outdoors the temperature moderates, say over Sunday, yet the radiators continue to pour out heat, running above normal, consuming costly fuel —and drying out the woodwork and walls, warping and otherwise damaging them, and in all creating tremendous loss over the year.

THE JOHNSON SYSTEM OF TEMPERATURE REGULATION never neglects nor forgets; it is consistent in its control of each radiator affected

ESTATE OF HENRY W. OLIVER

CENTRAL POWER PLANT AND
BUILDING MAINTENANCE DEPARTMENTS
WM G. BOYLE, SUPERINTENDENT

EDITH OLIVER REA
THE UNION TRUST COMPANY
OF PITTSBURGH
} TRUSTEES

PITTSBURGH, PA

F. C. McIntosh, Mgr.,
Johnson Service Company,
Pittsburgh, Pa.

Dear Sir:

Replying to your request we are pleased to state our experience with automatic temperature control, covering the points you mention. In the Henry W. Oliver Building we have a complete Johnson installation including over 1200 thermostats.

There are three particular advantages of such a system. First is the economy of steam consumption. A comparison of records for this and other buildings, making due allowance for other factors, shows that this economy amounts to practically 20%.

Second, is the ability to heat the building rapidly As soon as one part of the building has been brought to the desired temperature the radiator valves are automatically closed and the surplus steam is available for use in other sections of the building.

The third advantage is the uniformity of resulting temperatures in the rooms and the decrease in the number of complaints from tenants.

We have learned from experience that if a regulation system is kept in shape the up-keep expense is very low, but if it is permitted to get into a bad state of repair or if the tenants are encouraged to tinker with the apparatus it requires considerable time and material to make repairs.

We are pleased to recommend your system.

Very truly yours,

Wm G Boyle

by the outside temperature, and maintains the correct temperature indoors at all times and under all conditions. The human mind or hands need not be relied upon to accomplish this result. Moreover (and this is a valuable JOHNSON feature), human hands cannot manipulate JOHNSON Thermostats on the wall; they are sealed against handling and accessible only to temperature changes or the building engineer in charge. Furthermore, the Johnson Thermostat has back of it the JOHNSON SERVICE SYSTEM, which can be relied upon always. The Thermostats and diaphragm valves are made of *Metal.* All metal parts are used in thermostats; the celebrated Sylphon diaphragm is used in the valve, unaffected by age, heat or other deteriorating agents. These features keep the plant in operation constantly, never varying from exact regulation.

That THE JOHNSON SYSTEM OF TEMPERATURE REGULATION be installed in office and bank buildings, business blocks, clubs, factories, etc., is more imperative now than ever. Increasing coal cost and the necessary labor expense attached must be curtailed; there is now greater need for cost reductions than ever before. THE JOHNSON SYSTEM OF TEMPERATURE REGULATION will reduce fuel consumption from 15 to 50 per cent annually; the saving will pay for the installation in a few years and forever after the JOHNSON SYSTEM will continue to function in its annual saving capacity. Therefore, every large building, whether completed or under construction should be equipped with the Johnson System of Temperature Regulation. Plans and Specifications for the new building should include the Johnson System because of the efficiency of automatic control and because of the exclusive superiorities of Johnson.

VOLNEY T. MALOTT
CHAIRMAN OF THE BOARD
FRANK O. STALNAKER PRESIDENT

HENRY EITEL V. PRES.
ANDREW SMITH V. PRES.
MACY W. MALOTT, V. PRES.
EDWARD D. MORRE V. PRES.
GWYNN F. PATTERSON, CASHIER

The Indiana National Bank

CAPITAL $2,000,000 SURPLUS $1,000,000

THOS. M. TAYLOR, CASHIER
LEROY KAHLER, CASHIER
W. MALOTT FLETCHER, CASHIER
HERBERT S. WOOD, CASHIER
JOHN F. HURFISS, EDITOR

Indianapolis, Ind. Sept. 20, 1920.

Johnson Service Co.,
Indianapolis, Indiana.

Gentlemen:-

At your request, we are glad to state that the Indiana National Bank Building, this City, is equipped with the Johnson system of automatic Temperature Regulation throughout, this system having been in operation some ten years and given great satisfaction. We have always found that the Johnson Service Company was ready at any time to give up assistance when same was required.

In the matter of saving in dollars and cents, after we put our consumption of steam through a meter, we found that in one heating season we saved $2372.00. The saving was made by comparing the cost of our heating in an average winter against the cost of our heating for several years past when we did not have the meter and paid a flat rate.

Yours truly,
S Hamemon
Cashier.

An office building in Philadelphia with 20,384 square feet of direct radiation and without automatic temperature regulation averaged 1,344 tons of coal per year. A nearby building with 21,000 square feet of direct radiation and *with* Johnson automatic temperature regulation averaged 687 tons of coal per year. The building with greater radiation, but heat automatically controlled, used *657 tons of coal LESS per year.*

A University Club reduced its steam consumption from 56,000 pounds per day to 37,789 pounds per day, making a net fuel cost saving of 27 per cent.

Application of Johnson System of Temperature Control to Direct Radiator System of Steam, Vapor or Hot Water Heating

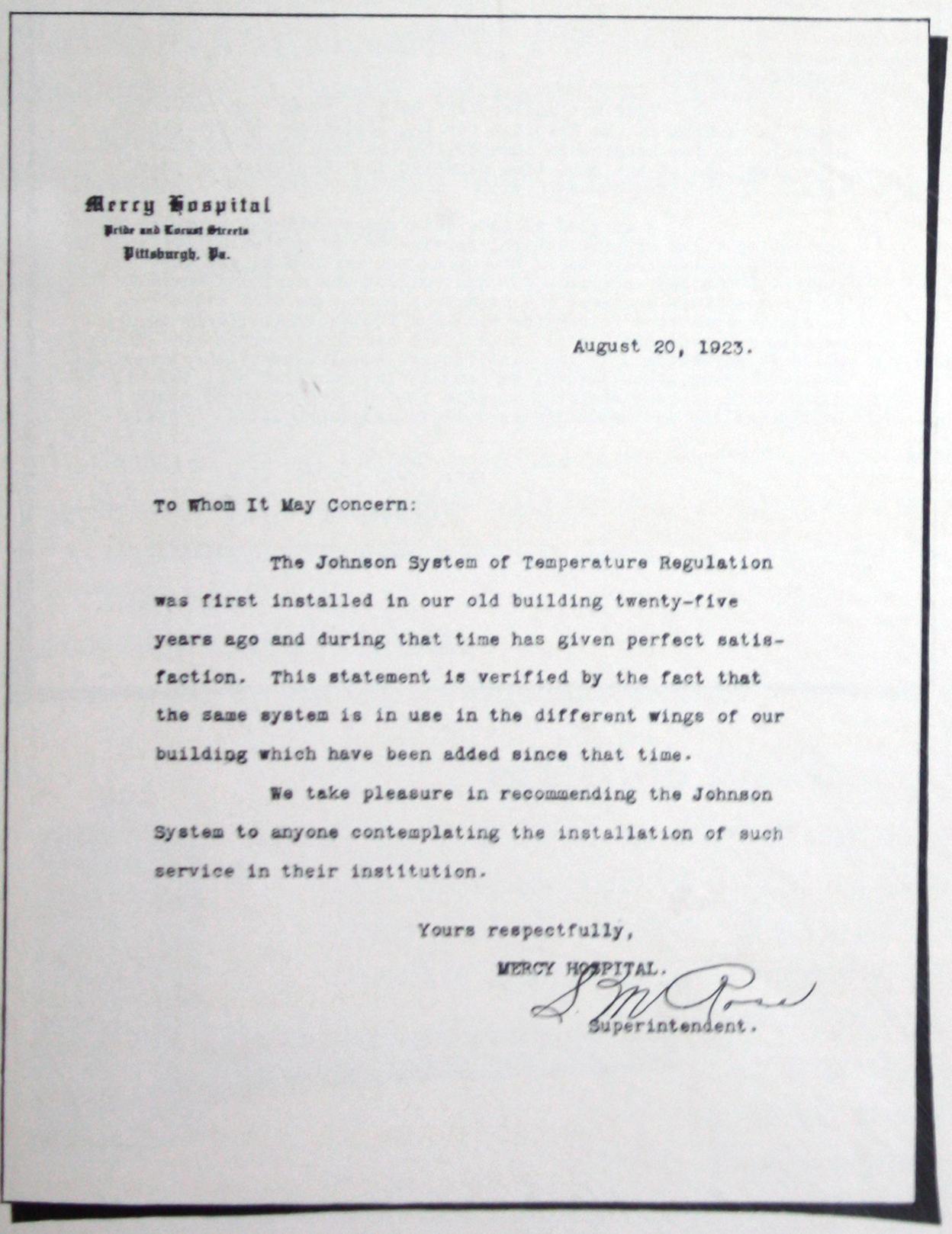
The direct system of heating is the most common of the many systems of heating and consists of one or more direct radiators (R) of sufficient capacity to furnish all heat required for the comfortable warming of the room, also air admitted through window for ventilation. Heat through the medium of steam under pressure, vapor, or hot water, is admitted to radiator through Johnson Sylphon Radiator Valve.

Automatic control of the system is accomplished as follows: Compressed air is furnished by Johnson Automatic Air Compressor and air storage system (not shown) through galvanized iron piping system (shown by blue line in cut) through air main (M) to Johnson Room Thermostat (T). When room temperature rises to point at which Thermostat (T) is set, air pressure is admitted to Johnson Sylphon Radiator Valve Diaphragm (V) through branch line (B) closing valve with either positive or gradual action as determined by type of thermostat used. Cooling of room through one degree causes Thermostat to exhaust air pressure from Johnson Sylphon Valve, allowing valve to open.

The Johnson System in the Hospital

The saving of 15 to 35 per cent annually in fuel consumption coupled with the savings in ash handling, water bill, deterioration to the building and fixtures, etc., is ample reason for installing the Johnson System of Temperature Regulation in the Hospital. This saving obtains whether the hospital operates its own heating plant, or purchases heat by meter measure from a central station. The saving the first few years will pay for the installation, and the system will continue forever after to contribute its annual benefits in lower fuel cost. At this time without any of the many other JOHNSON features distinctly favorable to hospitals, this big item of yearly fuel saving alone makes the installation important and advisable. Hospital overhead is an item difficult to reduce. A saving of 15 to 35 per cent on fuel alone is a long step toward greatly easing hospital overhead. Every hospital, contemplated, in course of construction, or already complete should include THE JOHNSON SYSTEM OF TEMPERATURE REGULATION for the economy features alone.

The JOHNSON SYSTEM is most appropriately a hospital expedient, because of its accuracy and constancy of performance, and because it fulfills the distinct requirements hospital exigencies create, in patients' rooms, in wards, corridors, convalescents' rooms, operating rooms, etc.



Mercy Hospital
Pride and Locust Streets
Pittsburgh, Pa.

August 20, 1923.

To Whom It May Concern:

The Johnson System of Temperature Regulation was first installed in our old building twenty-five years ago and during that time has given perfect satisfaction. This statement is verified by the fact that the same system is in use in the different wings of our building which have been added since that time.

We take pleasure in recommending the Johnson System to anyone contemplating the installation of such service in their institution.

Yours respectfully,

MERCY HOSPITAL.

Superintendent.

The JOHNSON Thermostat on the wall of each room, corridor, etc., controls and operates the valve of each radiator separately and independently of the radiators in all other parts of the building. The temperature condition of each room of the hospital can be maintained at exactly the degree necessary. This method is more reliable and accurate than regulation by hand; it is not dependent on human guess work, negligence or inaccuracy. Furthermore, there is no possibility of variation from the stipulated degree, no lowering or increasing the temperature of any room unless automatically required for night or day, or for certain hours. The relief from responsibility in this important hospital necessity, insured by the perfect performance of THE JOHNSON SYSTEM, adds to the necessity of hospital installations.

The Sylphon seamless metal bellows, the metal diaphragm used in

JOHNSON valves, is exclusively a JOHNSON feature, and cannot wear out or deteriorate with age from excessive heat or other causes. The performance of the system will not falter, fail or vary in its operation. The working parts are made of material that will not change from the perfection with which the system is installed. Hospitals have the utmost surety of being equipped with temperature regulation that meets their delicate and vital standards of dependable perfection when The JOHNSON SYSTEM is used. THE JOHNSON SYSTEM will continue to perform its functions reliably as long as the building itself stands. With the different temperature conditions definitely required in all rooms and departments, no hospital can be considered really efficient, in behalf of its operatives and patients, unless THE JOHNSON SYSTEM OF TEMPERATURE REGULATION is installed. Every part of The JOHNSON SYSTEM, from the sealed Thermostats on each wall and the thermostatically operated valves on each radiator to the air compressor in the basement is all JOHNSON designed and manufactured, JOHNSON installed, guaranteed and maintained by service. The close contact of product and manufacturer and the efficient results obtained from this equipment, vouchsafe for any hospital's greater welfare with an installation of THE JOHNSON SYSTEM OF TEMPERATURE REGULATION.

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#55 Kilby Street,
Boston, Mass., May 8, 1923.

The Johnson Service Company,
#31 Waltham Street,
Boston, Mass.

Mr. H. B. Wiegner

Dear Mr. Wiegner:

Your Mr. Miller left with me today your Assembly Book, to be kept at the Hospital for the assistance of the chief mechanic and for service in identifying the many parts of your apparatus, and at the same time reported the completion of your work.

I am glad to take this opportunity of expressing our satisfaction of your control service on our hot water system, general room temperatures in the wards and nurseries, and particularly the special apparatus for controlling the heat and humidity in the premature nursery. The reports I have show that all of the automatic apparatus is working well and I wish particularly to mention our appreciation of the uniform courteous service and Mr. Miller's persistency in the satisfactory completion of the premature nursery installation. We feel at the Hospital that this is going to be of very material benefit in the care of these small babies and the doctors are very much pleased with it.

Very truly yours,
H. Hooper Lawrence
H. HOOPER LAWRENCE, PRESIDENT.

Johnson Electric Thermostat

For the operation by temperature of electric motors, magnetic or solenoid valves and electric heaters, the electric thermostat and electric humidostat have some advantages over and are more in demand than the pneumatic thermostat. These electric thermostats are made in several styles to meet various requirements, and our long and wide experience in manufacturing thermostats has enabled us to produce instruments which we can guarantee to be accurate, efficient and durable and to meet all the demands of electric control.

The following pages contain a description of the two principal kinds of electric thermostats and humidostats that we make—the wall type and the inserted type. Both of these types are made in a variety of forms to meet various conditions, but we describe only one form of each type as they are all made on the same principle and are practically of the same size, but can be and are modified for special purposes.

Wall Electric Thermostat

ADAPTED—when used in connection with our control switches, for control of:

Electrically heated rooms.

Temperature in small refrigerators, cooled by electrical driven ice machines.

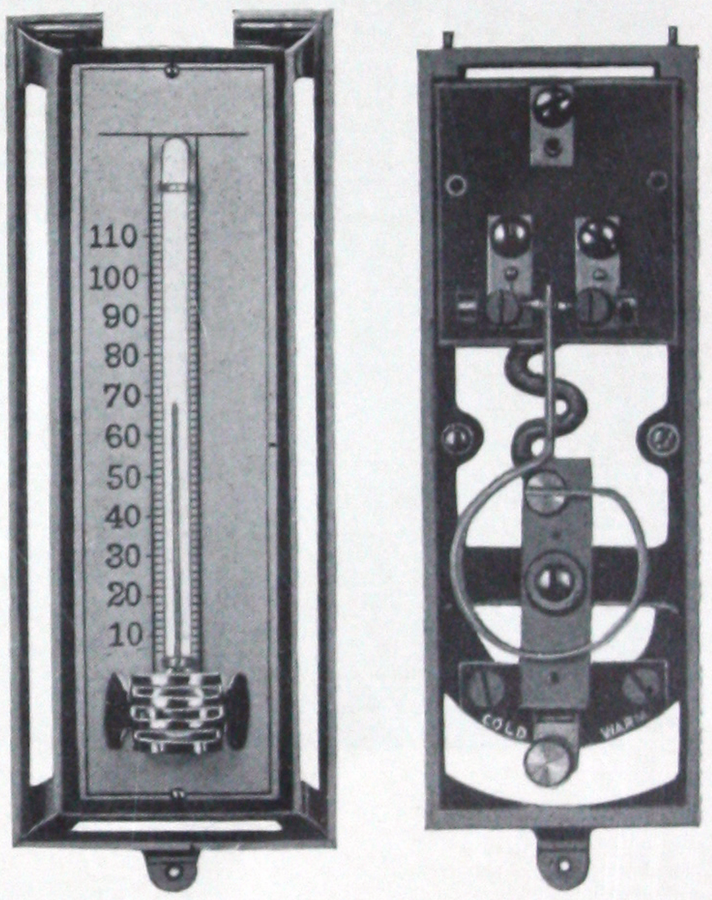
Electrically driven centrifugal pumps used for cooling or heating purposes.

Motors driving heating, cooling or ventilating fans, such as are used in fur vaults, etc.

CURRENT—For the thermostat circuit is obtained from the power circuit through a special device mounted on the control panel which reduces it to the maximum voltage which the thermostat will carry. THE THERMOSTAT MUST NOT BE CONNECTED DIRECTLY TO THE POWER CIRCUIT.

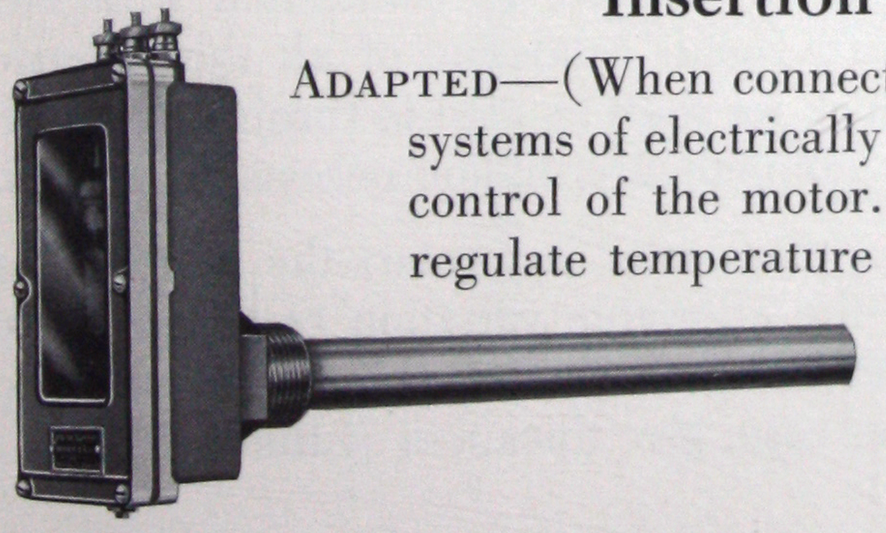
ALSO—On battery circuits.

For the operation of temperature alarms.



For the control of furnace draft regulators.

Insertion Electric Thermostat



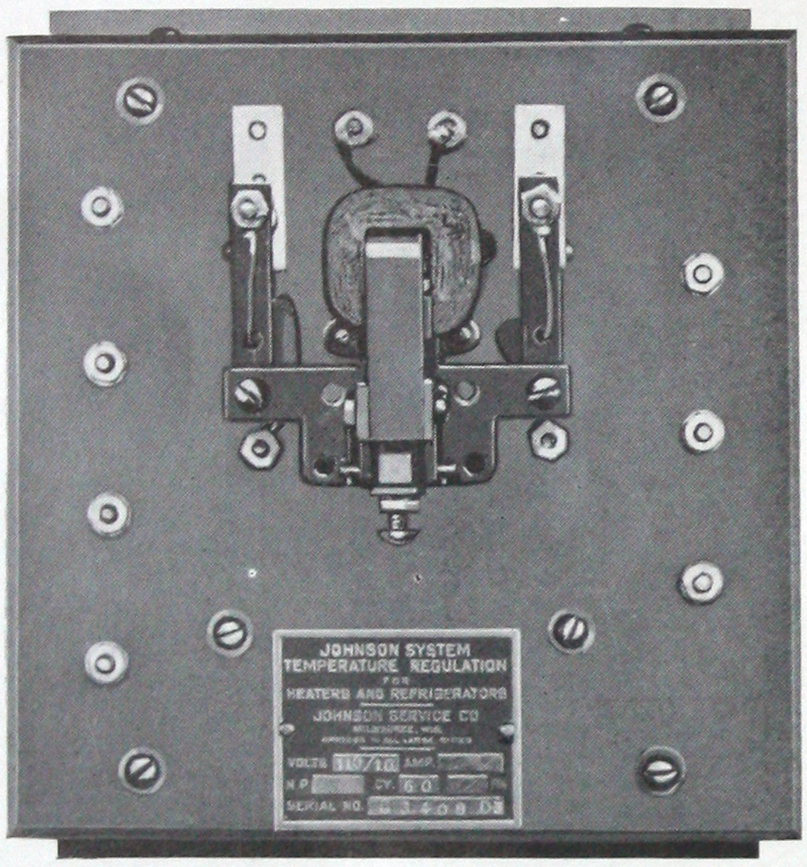
ADAPTED—(When connected to one of our controllers.) For insertion in brine systems of electrically driven machines to regulate the temperature of brine by control of the motor. For insertion through the wall of a refrigerator to regulate temperature of cooled place by the control of the motor. For the control of brine circulating pumps either by insertion in the brine or in the cooled place. For insertion in water systems cooled by motor driven ice machine or motor driven brine circulating pumps to regulate the temperature of the water by the control of the motor, where the changes in temperature are slow and a range of 4 or 5 degrees is permissible.

CURRENT—For the thermostat circuit is obtained from the power circuit through a special device mounted on the control panel which reduces it to the maximum voltage which the thermostat will carry. THE THERMOSTAT MUST NOT BE CONNECTED DIRECTLY TO THE POWER CIRCUIT.

OPEN CIRCUIT BATTERY—For temperature alarm bells, high or low alarm, or both. For the operation of small electric motor driven or clock work draft regulators on hot water heating systems.

NOTE—In ordering, state whether for heater or refrigerator control. NOT TO BE USED TO CONTROL HIGH TEMPERATURES.

Relays



Electric Thermostats and Humidostats listed in this Catalogue, cannot take current directly from the lighting or power circuit, but must operate the switch or starter through our special relay. The relay reduces the voltage in the thermostat circuit to a point which is adapted for thermostatic use and maintains the accuracy and efficiency of the thermostat or humidostat.

These relays are capable of handling motors up to ¾ H. P., but beyond that a motor starter must be used in connection with the thermostat and relay. The price of electric thermostats and relays and electric humidostats and relays with discounts for quantities will be quoted on application.

Electric Motor Starters

There are so many different types of motors for different purposes which require different types of motor starters that we do not attempt to manufacture starters. We are prepared, however, to quote prices and furnish suitable starters for any motors in connection with our electric thermostats and relays, if desired. We publish a small catalogue of all this electric apparatus, including thermostats, relays and starters, which we shall be glad to furnish on application and to quote prices on apparatus desired when the complete information necessary is given.

In addition to electric information, state whether the thermostat is to start the motor on a rising or a falling temperature; what temperature and the allowable variation of temperature between the starting and stopping of the motor. Also whether the thermostat is to be inserted into brine or other liquid or into an air chamber. In the latter case, give thickness of the walls.

FINALLY

JOHNSON SERVICE COMPANY is manufacturer, engineer, contractor. In this triple respect it is thoroughly equipped to co-operate with the building owner, the building committee, the architect, consulting engineer and contractor. As manufacturer, this company produces the finest, most efficient and greatest variety of apparatus for controlling temperature: thermostats, valves, dampers, air compressors, humidostats, etc. As engineer, it has an organization of university graduates and practical mechanics to assist architects or engineers in developing their plans and working out the most economical methods. As contractor, with a most complete organization, branch offices, superintendents, mechanics, etc., the best installation of temperature and humidity control is assured. And the business of JOHNSON SERVICE COMPANY is exclusively that of temperature and humidity control, and to that end devotes its experience and entire energy to the best results for those served.

JOHNSON SERVICE COMPANY

MAIN OFFICE AND FACTORY:

MILWAUKEE, WISCONSIN

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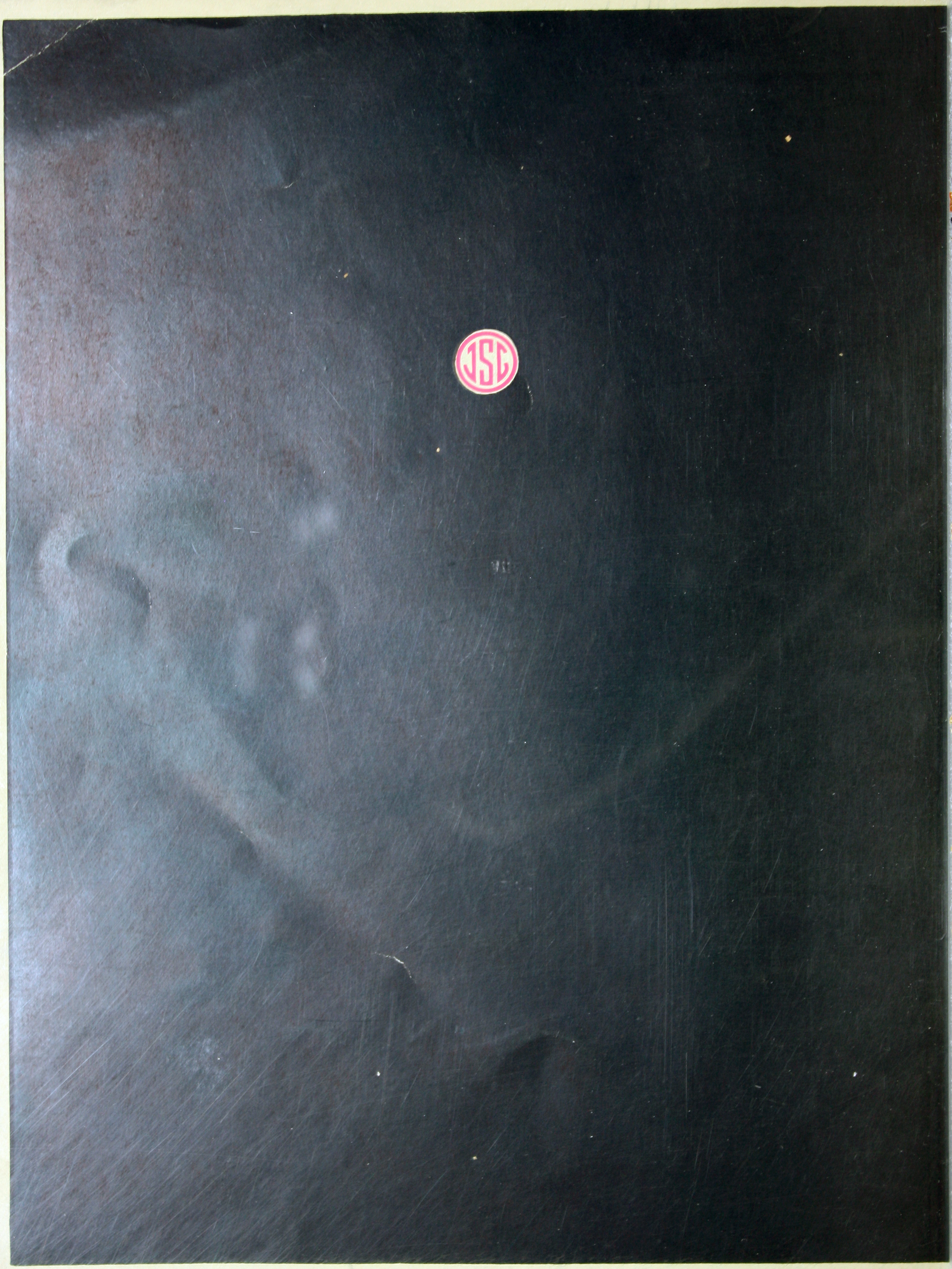
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